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ABSTRACT

This guide was developed to assist the teacher in planning, implementing, revising, or improving safety instruction in industrial arts classes in New Jersey, and has as its theme, "Safety Is Everyone's Responsibility." The guide is organized in seven major sections. The first section explains the purpose of the guide, outlines the contents of a vocational education safety program, and lists the objectives of an industrial arts safety education program. The second section allocates the responsibilities for industrial arts safety among educators, administrators, staff, parents, and students. Emergency procedures are the topic of the third section; first aid, substitute teachers, and school accident reporting are discussed. The fourth section spells out general industrial arts safety education policy, including teacher ethics, avoiding liability, avoiding negligence, use of school equipment, parent awareness, safety inspections, and safety education aids. The fifth section lists safety standards for facilities, color coding, signs, floor areas, floor materials, class size and shape, illumination, ventilation, material handling and storage, fire and electrical safety, laboratory maintenance, hearing and noise exposure, and personal protective equipment. In the sixth section, safety instruction techniques are suggested including rules for hand tools, power equipment, and specific laboratory safety rules. The final section consists of equipment instruction sheets and evaluations, illustrated with line drawings. A bibliography is included. A copy of all pertinent New Jersey safety legislation appears in the appendices, including copies of the accident reporting form, recommended facility capacities, industrial arts education safety test and school safety inspection checklist, and an end-of-year checkout checklist. (KC)

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# Industrial Arts Education
# SAFETY GUIDE

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Rutgers – The State University
Building 4103 – Kilmer Campus
New Brunswick, New Jersey

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# NEW JERSEY
## Industrial Arts Education
# SAFETY GUIDE

Joseph D. Kobylarz

Garfield High School

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Northern Highlands Regional High School



April 1983

ACKNOWLEDGEMENTS

To paraphrase Edmund Burke, 18th century English orator statesman, "We are but pygmies standing on the shoulder of giants."

This project was funded by the State of New Jersey, Department of Education, Division of Vocational Education and Career Preparation, under the RFP proposal system. The project's intent was to search out existing materials and adapt them to the needs of a New Jersey State Safety Guide. The project's co-directors, therefore, consider their role in the project as contributors and coordinators.

Considerable reliance was placed upon the following sources for materials:

Code for School Planning and Construction, State of New Jersey

New Mexico Vocational-Industrial Safety Guide

Pennsylvania Industrial Arts Safety Guide (Graham)

Safety Education in the School Shop, Gorham, Maine

Safety Manual for North Dakota Vocational Education (Esbellig)

State of Idaho Industrial Arts Safety Guide

State of New Jersey Safety Manual for Cooperative Industrial Education

Washington State Industrial Arts Safety Guide

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The co-directors want to publicly express their appreciation and thanks to their wives, Joyce and Jennie, for their continuing encouragement and patience.

June 1982

Joseph D. Kobylarz
Francis B. Olender

# FOREWORD

The safety and health of all individuals participating in industrial arts education activities are vital concerns and continuing challenges. The shop and laboratory learning environment, by its very nature, can expose participants to situations that are potentially threatening to their safety and health.

The potential threat can be significantly reduced or eliminated through the cooperative efforts of students, instructors, administrators, and boards of education acting in harmony in support of comprehensive industrial arts safety education.

This Industrial Arts Education Safety Guide was developed to assist the reader in planning and implementing new safety instruction or in revising and improving existing instruction. The guide is well organized and researched and will prove to be a significant contribution to furthering the safety and health education efforts in New Jersey's industrial arts education programs.

This guide, developed by Joseph D. Kobylarz, Garfield High School, and Francis B. Olender, Northern Highlands Regional High School, is a superb tribute to their dedication to, and their sincere concern for, industrial arts education.

William R. Smith, Director
Facilities/Equipment and
Safety Control
Division of Vocational Education
and Career Preparation

# PREFACE

Since the state safety legislation sets the minimum benchmarks of acceptable school safety requirements, every industrial arts education teacher and supervisor must become versed in that legislation. It is only through a thorough knowledge of the legislation that one will be able to evaluate safety violations, hazards, and exposure existing in their school systems and thereafter take corrective steps to eliminate those conditions.

A copy of all pertinent state safety legislation is included in the Appendices. Special attention should be given to the Vocational Education Safety Standards (Appendix L). It establishes the regulations applying to all public schools having industrial arts education programs. It also lists the requirements for individual school's safety programs.

In December of 1977, the New Jersey Department of Education, Division of Vocational Education and Career Preparation, established a precedent setting accident reporting system using the Accident Reporting Form MIS 07D007 (Appendix B). Each school is mandated to report all vocational program accidents requiring treatment by a licensed medical doctor. This is an attempt to gather accident-related data on industrial arts education programs (one part of the vocational education system).

A summary of the reported accidents is released periodically. The accident summary report tallies the reported accidents by grade level, day of the week of occurence, time of accident, type of course where accident occurred, and the part of the body injured. The data are analyzed to ascertain areas where the greatest number of injuries occur and to recommend safety practices to reduce those accidents. All industrial arts education teachers and supervisors should have a copy of this report available for their reference. The accident summary report is mailed to each school superintendent and copies can be requested from them.

An industrial arts school safety inspection check list (Appendix J), prepared by the New Jersey Department of Education, Division of Vocational Education and Career Preparation, in cooperation with the Industrial Arts Education Association of New Jersey, has been developed to assist school personnel in ascertaining, and correcting if necessary, safety conditions in the industrial arts education areas. It is a good tool to use for health and safety "measurements."

A sample safety test (Appendix I) and the evaluations attached to the Equipment Instruction Sheets have been developed by the authors as a means of evaluating the students' knowledge of safety. The same test, obviously, should not be used verbatim year after year. Some pertinent basic test-question development rules-of-thumb have been added for consideration by the instructors.

To assist instructors in their efforts to close out the school year, an end-of-year safety checkout check list (Appendix K) has been developed so that the process may be carried out systematically and thoroughly.

The authors have reviewed and synthesized safety manuals and related materials from many sources, and they have taken advantage of their many years of experience, to produce an effective safety guide. If it is used as intended, industrial arts shops should be healthier and safer laboratories for relevant instruction to take place.

Irving E. Bach (Editor)

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# INTRODUCTION

# INTRODUCTION

## Purpose of the Guide

This guide is not intended to be a complete and all-inclusive safety instruction or safety program text. Its aim is to draw attention to the necessity for planned safety instruction. It is hoped that the guide will provide direction and resources to upgrade and improve safety instruction in the shop and classrooms.

The New Jersey State Board of Education adopted, on August 3, 1977, the Vocational Education Safety Standards, Title 6, Chapter 53 of the New Jersey Administrative Code which requires all boards of education operating courses and/or programs in vocational education to organize, adopt, and implement a vocational safety education program designed to safeguard employees and students from accidents, and to maintain at all times an effective safety organization. (Appendix L. Safety Standards as ammended in 1982)

Schools responded to the above mandate with varying degrees of efficiency. The purpose of this guide, therefore, is to offer a source of reference, based upon current data, to aid the educator in developing an industrial arts education safety program which will meet the intent of the law. This guide is not to be used to circumvent the requirement for individually-approved board of education programs. Boards of education may adopt portions of this guide, or revise them to suit individual program needs.

Placing the guide in a loose leaf binder makes it flexible and easy to use by industrial arts education teachers and supervisors. Recognizing that laws will change and that new developments in safety will occur, the loose leaf binder permits making additions and revisions without reprinting the entire document.

All material contained in this guide may be reproduced by the teacher for use in safety instructions. It is desirable that the teacher, in constructing a safety education program, consider development of personal supplementary materials, lesson plans, safety instruction sheets, and safety quizzes to expand the classroom safety experiences.

## Contents of a Vocational Education Safety Program

The New Jersey Vocational Education Safety Standards specifically require that the vocational education safety program contain minimum provisions. This is an exceedingly important and crucial part of any school safety program.

Minimum requirements for a local board of education's vocational safety program are as follows:

1. Objectives of the vocational safety education program.

2. A statement of the general policies for the safe operation of vocational courses.

3. Specific statements of practice and precautions required for safe operation within each separate course.

4. A plan for periodic inspections and maintenance of facilities, tools, machines, equipment, and personal protective devices.

5. A plan for the identification and elimination of potential hazards.

6. Emergency procedures to be followed in the event an accident occurs involving a student, teacher, or any other individual.

7. Methods to be used to provide safety education to students.

8. Methods to be used to assess a student's knowledge of safe practices and procedures.

## Objectives of an Industrial Arts Safety Education Program

Suggested objectives of a typical industrial arts safety education program are as follows:

1. Develop a positive attitude in teachers and students towards safety in the shop.

2. Establish and adhere to general safety standards and practices.

3. Establish uniform machine and equipment safety instructions.

4. Supply the student with sufficient information and instruction on safety procedures on the various pieces of equipment.

5. Develop and maintain a safety inspection plan for facilities.

6. Develop and execute a plan to alleviate unsafe conditions over which there is control.

7. Establish and maintain a safety color-coding system.

8. Establish and maintain an accident reporting system compatible with State Department of Education requirements.

9. Make parents aware of the importance of safety, and the gravity of safety infractions.

10. Create and administer a standard written and performance safety test for each machine operation.

11. Develop a consciousness in all participants of wearing specific protection gear as required in designated shop areas.

12. Develop an awareness of lighting, ventilation, traffic flow, and other general physical conditions of a work area that affect the safety of students or teachers.

13. Develop a student routine of proper housekeeping (including the orderly arrangement of tools, equipment, storage facilities, and materials) before, during, and after a work session.

14. Develop the ability to recognize potential hazards and take appropriate measures to avoid or eliminate them.

15. Develop corrective procedures for infractions of the safety education program.

# RESPONSIBILITIES

## Sharing the Responsibility for Safety Education

Safety is not one individual's responsibility. It is everyone's! The responsibility for the development and administration of an effective school safety education program rests with the individual school district's board of education and its administration. The teachers, students, and school employees are responsible for adhering to the school safety program and making constructive recommendations for its implementation. Parents are encouraged to contribute their expertise in making the safety program effective.

It is obvious that there is not one optimum type of school safety program organization and distribution of pertinent responsibilities. This chapter suggests a possible responsibility distribution plan (Figure 1) which should offer guidance in the development of a viable program. School districts can use the suggestions as a guide but must recognize the need to incorporate individual school requirements.

It must be stressed that, though it is the board of education's responsibility to develop and administer the school's safety program, its effectiveness is dependent upon all those individuals affected by the program.

## Board of Education Responsibilities

The board of education has been delegated the responsibility for the satisfactory operation of the schools in the district. This includes all programs and facilities. The major program that requires total commitment by the board of education is the comprehensive safety program. This program must involve all school district personnel.

The following functions are considered to be the responsibilities of the board of education:

1. Adopt a written commitment to develop and maintain an active comprehensive safety program.

2. Provide for the safety of its employees.

3. Provide for a program of safety instruction to be integrated into the curriculum at all grade levels and in all subjects.

4. Approve a policy consistent with New Jersey state law that will:
   a. establish a district-wide safety program.
   b. encourage personal safety.

5. Provide resources necessary for improvement and maintenance of its facilities as required by the comprehensive safety program.

6. Provide for proper liability insurance protecting employees and students in case of accident-related injury.

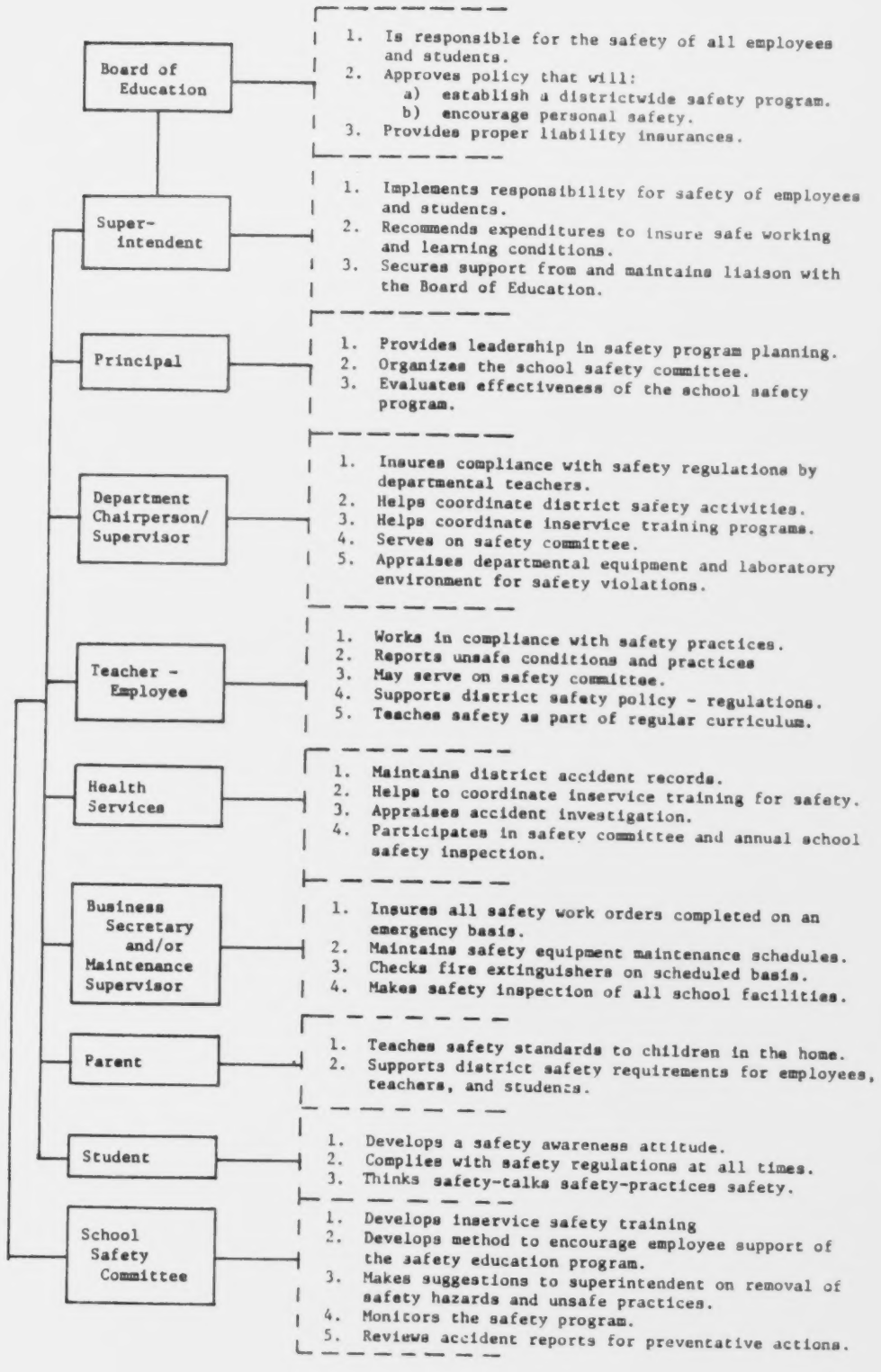
Board of Education
1. Is responsible for the safety of all employees and students.
2. Approves policy that will:
a) establish a districtwide safety program.
b) encourage personal safety.
3. Provides proper liability insurances.
Super-intendent
1. Implements responsibility for safety of employees and students.
2. Recommends expenditures to insure safe working and learning conditions.
3. Secures support from and maintains liaison with the Board of Education.
Principal
1. Provides leadership in safety program planning.
2. Organizes the school safety committee.
3. Evaluates effectiveness of the school safety program.
Department Chairperson/ Supervisor
1. Insures compliance with safety regulations by departmental teachers.
2. Helps coordinate district safety activities.
3. Helps coordinate inservice training programs.
4. Serves on safety committee.
5. Appraises departmental equipment and laboratory environment for safety violations.
Teacher - Employee
1. Works in compliance with safety practices.
2. Reports unsafe conditions and practices
3. May serve on safety committee.
4. Supports district safety policy - regulations.
5. Teaches safety as part of regular curriculum.
Health Services
1. Maintains district accident records.
2. Helps to coordinate inservice training for safety.
3. Appraises accident investigation.
4. Participates in safety committee and annual school safety inspection.
Business Secretary and/or Maintenance Supervisor
1. Insures all safety work orders completed on an emergency basis.
2. Maintains safety equipment maintenance schedules.
3. Checks fire extinguishers on scheduled basis.
4. Makes safety inspection of all school facilities.
Parent
1. Teaches safety standards to children in the home.
2. Supports district safety requirements for employees, teachers, and students.
Student
1. Develops a safety awareness attitude.
2. Complies with safety regulations at all times.
3. Thinks safety-talks safety-practices safety.
School Safety Committee
1. Develops inservice safety training
2. Develops method to encourage employee support of the safety education program.
3. Makes suggestions to superintendent on removal of safety hazards and unsafe practices.
4. Monitors the safety program.
5. Reviews accident reports for preventative actions.

Figure 1. A District's Safety Responsibility Organization Chart

## Board of Education Policy Statement

The Board of Education recognizes its responsibility in providing the safest conditions for its employees and students. The educational process and safety are inseparable. The effectiveness of the school's instructional program is in large part determined by an environment free from disruptions to the learning process. It is recognized that employee or student accident injury or illness results in a loss of educational productivity. Accidents resulting in personal injury and damage to property and equipment also represent needless waste.

It shall, therefore, be the policy of the district:

1. that all practical steps be taken to safeguard employees and students from accidents, and to maintain, at all times, an effective safety organization (Appendix A), and

2. that effective supervision of students shall remain in force whenever students are on campus or under supervision of school personnel. Student safety shall be an integral part of the curriculum at all grade levels and in all subjects (Appendix A).

The Board recognizes the Occupational Safety and Health Act of 1970 and the safety regulations established by the State Board of Education to be appropriate and consistent with the purposes of the District.

## Superintendent's Responsibilities

The Superintendent, as the senior administrative officer in the school district, has the responsibility of implementing the comprehensive safety program. The following functions are considered to be the superintendent's safety program responsibilities:

1. Make recommendations to the Board of Education to provide the necessary resources for the comprehensive safety program.

2. Encourage all staff members to incorporate safety instructions into the curriculum at all grade levels and in all subjects.

3. Evaluate the adequacy of the comprehensive safety program.

4. Evaluate the adequacy of the comprehensive safety program.

5. Inform employees and students about the extent of coverage of the district's liability insurance.

6. Provide for the inspection and maintenance of all shop machinery and equipment on a regularly scheduled basis to insure safe performance (Appendix J).

7. Participate in the selection of a school safety committee.

8. Secure support from, and maintain liaison with, the Board of Education.

## Principals' Responsibilities

Principals are usually the senior administrative officers in the individual schools. They play a unique role in the structure of the comprehensive safety program. As maintainers of morale and discipline, the principals set the example for safety awareness. Their commitment to the program will insure success. The following functions are considered to be the responsibilities of principals in establishing and maintaining a safety program:

1. Secure support from, and maintain liaison with, the superintendent and the Board of Education.
2. Aid in securing approval of the school safety program.
3. Aid in expediting building and equipment changes necessary for safe operation to meet state requirements.
4. Approve and arrange for the procurement of safety equipment as per state requirements.
5. Provide leadership in safety program planning.
6. Organize the school safety committee.
7. Encourage the instructional staff members to be alert to school safety.
8. Evaluate the school's comprehensive safety program.
9. Check periodically to make sure that the adopted safety program is in effect.
10. Receive and review accident reports.
11. Suggest corrective program changes.
12. Encourage the selection of staff instructors having specific knowledge and ability to establish safe practices and procedures necessary for a safe class/laboratory environment.
13. Recommend inservice workshops to upgrade staff members' knowledge of safe practices.

## Department Chairpersons'/Supervisors' Responsibilities

Department chairpersons/supervisors are the first line administrators to the school's teaching staff members. They usually teach classes as well as perform their administrative duties. Because of this unique position in school organization, they can provide an effective role model in the success of the school's safety program. The following functions are considered to be the responsibilities

of department chairpersons/supervisors to insure an effective comprehensive school safety program:

1. Secure support from, and maintain communication with, the school's administration.
2. Recommend approval of the department's specific safety program.
3. Recommend budgetary requirements to support the safety program.
4. Make safety equipment recommendations and seek its procurement.
5. Inform appropriate staff members of specific maintenance requirements for safe operation in the laboratory/classroom facilities.
6. Provide leadership in safety program planning and execution.
7. Initiate specific departmental safety program.
8. Arrange for teacher inservice training in accident prevention.
9. Encourage the instructional staff members to maintain first aid proficiency.
10. Instruct the staff members in the use of fire apparatus.
11. Instruct the department's staff members in the use of the safety program guide and in the development of a comprehensive safety program.
12. Initiate a positive teacher and student attitude regarding the safety program.
13. Check periodically to insure that the adopted safety program is in compliance with the state's safety standards.
14. Observe teachers to insure that safety instruction is a functioning part of the curriculum.
15. Stimulate the discovery, analysis, and prompt correction of unsafe conditions or practices.
16. Support teachers in enforcing safety regulations.
17. Receive, analyze, and synthesize accident reports.
18. Aid in providing safe facilities and services.
19. Report to administration personnel unsafe conditions which cannot be corrected at the school level.
20. Plan with teachers the correction of unsafe conditions and the installation of safety devices.

21. Make periodic facility inspections for proper condition of equipment, safety devices, adequate and open exits, and proper housekeeping.

22. Recommend class sizes that are in keeping with the capacity, square footage, and number of work stations available in each facility.

23. Establish guidelines for the correction of student infractions of the safety program.

24. Secure cooperation of outside personnel and agencies for the purpose of locating qualified community personnel and services that can provide resources for the safety program.

25. Establish communication with parents for developing positive attitude towards school safety.

Teachers' Responsibilities

Teachers are the key to a successful comprehensive safety program. They develop positive safety attitudes and awareness towards unsafe working conditions or practices. Teachers are the persons responsible for putting innovative safe programs into practice. They set the immediate example for the students to follow. The major responsibility for laboratory safety instruction in accident prevention falls on them. The following functions are considered to be the responsibilities of teachers in a comprehensive safety program:

1. Incorporate safety instruction into the course of study. Maintain documentation as to when instruction was given and which students received the instruction.

2. Present and document instruction on potential hazards and accident prevention specific to the particular school facility.

3. Initiate a comprehensive safety program for a particular school facility.

4. Develop specific safety practices and regulations relating to facilities. Provide for the enforcement of those practices and regulations.

5. Keep informed of new and accepted safety practices for accident prevention.

6. Set a proper safety example for students to follow (a role model).

7. Require that adequate eye protection devices be worn in all industrial arts education laboratories at all times in accordance with N.J. Statutes, 18A:40-12.1 on, and N.J. Administrative Code, 6:3-1.4 (Appendix G).

8. Require proper protective equipment (clothing, guards, etc.) be used in all laboratory areas.

9. Establish and enforce safe housekeeping procedures.

10. Require that guards meeting accepted standards be provided and used whenever a machine is operated.

11. Carry out preplanned procedures in case an accident or emergency occurs.

12. Provide prompt and thorough reports of accidents in accordance with state requirements (Appendix B), including:

    a. Written report by instructor.
    b. Written accounts by witnesses.
    c. Photographs of accident scene and conditions, where possible.

13. Provide for the supervision of students in the classroom/laboratory in accordance with legal requirements.
    Note: Instructor is not to leave the classroom unsupervised at any time when students are present!

14. Provide input in development of Individualized Education Program (IEPs) for classified students, placing special emphasis on unique safety considerations.

15. Regularly review laboratory facilities to maintain safe conditions, giving special attention to:

    a. layout,
    b. utilities and building services,
    c. equipment guarding,
    d. storage and condition of tools,
    e. storage, labeling, and handling of flammable, combustible, or potentially hazardous materials, and
    f. personal safety equipment and practices.

16. Make recommendations to department chairperson/supervisor for improving safety conditions.

17. Carry out recommendations of administration for improving safety instruction.

## Parents'/Guardians' Responsibilities

Developing positive safety attitudes in students cannot be accomplished by a school safety education program and the classroom instructors' efforts alone. Parents/guardians, as responsible community members, have vital roles in the establishment of safety awareness in their children. The following functions are considered to be the responsibilities of parents/guardians in the overall safety education program:

1. Reinforce safety concepts at home.

2. Teach home safety standards to children in the home.

3. Support the school's comprehensive safety education program.

4. Provide the student with the proper clothing to function safely in the school environment.

5. Support the need for adequate safe equipment and supplies.

6. Inform Health Services of unreported student injuries.

7. Impress upon the students the importance of thinking safety - talking safety - practicing safety.

Students' Responsibilities

A prime purpose of any school safety program is to protect the students from accidents. They are the catalysts to a successful school safety education program. The following student responsibilities must be established to maintain an effective safety education program:

1. Comply at all times to the safety regulations.

2. Develop a safety awareness attitude.

3. Report all injuries to the teacher immediately.

4. Operate any machine only after both the written and performance safety tests are completed successfully.

5. Understand and apply the safe operation instructions to all machines.

6. Adhere to teacher's instructions at all times.

7. Wear the proper clothing always.

8. Inform the instructor of all unsafe conditions immediately.

Health Services' Responsibilities

An important phase of a successful safety program is a sound emergency procedure. The dissemination of information on first aid and emergency procedures falls to the health Services Department. Following are the responsibilities of Health Services to maintain a successful safety program:

1. Establish a vocational education first aid emergency procedure.

2. Maintain district accident records.

3. Carry out accident investigations.

4. Participate in safety committee and annual school safety inspection activities.

5. Recommend and coordinate inservice safety training for school personnel.

6. Submit required accident report forms as mandated by state regulations.

## Business Secretary and/or Maintenance Supervisor's Responsibilities

The business secretary and/or maintenance supervisor are the school staff personnel given the responsibility of getting the physical work done. Securing the necessary equipment and facility changes to insure a safe, operative environment is their responsibility, along with the following:

1. Complete all safety-related work orders on an emergency basis.

2. Be familiar with the total school safety education program.

3. Maintain safety equipment maintenance schedule.

4. Make safety inspection of all school facilities.

5. Recommend facility changes, when needed, to insure safe environment.

6. Make sure that regularly scheduled checks on school's fire extinguishers are performed by qualified persons.

## School Safety Committee's Responsibilities

It is essential that every employee and student of the district be informed of the safety education program. This can best be accomplished by the use of a school safety committee. The size of the committee should be determined by each local school district. It is recommended that at least three members serve on the committee. One from administration, one from industrial arts education, and one from another school discipline. The school safety committee's functions are to:

1. Monitor the existing safety education program.

2. Help disseminate safety information.

3. Respond to analysis of accident data.

4. Help establish inservice first aid workshops.

5. Help establish inservice safety workshops.

6. Conduct regular school safety inspections.

7. Recommend equipment and facility changes to insure a safe environment.

# EMERGENCY PROCEDURES

## Emergency Action

An important phase of a successful safety program is a sound emergency procedure. Emergency situations can arise at any time in the industrial arts education laboratories. The procedures for dealing with these events should be developed and approved by the local district (Appendix A). The procedures should be reviewed and revised periodically to ascertain their effectiveness and to make necessary modifications.

When an injury occurs, there are two aspects of emergency procedures that must be considered. The first concern is the action that should be done immediately following injury - the Primary Concerns. The second concern is the action that should be taken after the confusion has subsided and the injured party has been treated - the Secondary Concerns. In both of these phases, Health Services (medical officer, school nurse, etc.) plays an important part.

The following information is provided to serve as an emergency action plan for the teacher, student, and administration to follow.

## Primary Concerns

Primary concerns relate directly to the injured person and the reduction of further injury to that person. The degree of emergency care is dependent upon the extent of the injury and the qualifications of the person administering the care. If teachers are not qualified in first aid, they should only take actions that will assure no further injury befalls the injured person and immediately seek the help of the school nurse. This might be limited to stopping bleeding or covering a person in shock with a blanket.

Suggested emergency procedures to be followed, in case an accident occurs involving a student, are:

1. Immediately cut off the power.

2. Determine the extent and type of injury and simultaneously send for the school nurse.

3. Apply only the first aid that is necessary until trained medical aid arrives.

4. Disperse the crowd. Keep the injured person and surrounding area as quiet as possible.

5. Notify the department head and/or principal by student messenger. Do not leave the injured person alone.

6. If the injury is minor (splinter, slight cut), send the student to the school nurse accompanied by another student. An injured student should not be sent to the nurse alone.

7. If a foreign particle has entered the eye, send an accompanying student with the injured student to the school nurse. A teacher should never attempt to remove an object from a student's eye. If a liquid has entered the eye (acid, etc.), immediately wash the eye in an eye wash station and contact the nurse.

8. At the conclusion of emergency care, the proper accident report forms should be completed according to an established school safety education requirement.

Note: It is the teacher's responsibility to know what to do and what not to do in the event an accident occurs and to be familiar with the school's emergency procedures. (Teachers should take advantage of workshops in first aid presented by the American Red Cross, local ambulance corps, and district inservice programs.)

Suggested emergency procedures to be followed, in case an accident/injury occurs involving a teacher, are:

1. It is recommended that during the first week of class the students be oriented in safety instruction (including procedures to be followed in the event of a teacher injury).

2. A student lab manager and assistants should be selected to provide help in case of teacher injury.

3. At first warning of an injury involving a teacher, all students should cease activities and report to the teacher's desk area and await instructions.

4. If the accident produces fumes and/or fire, an alarm is to be activated.

5. If a teacher has an accident/injury, the students should pursue the established procedure, as follows:

   a. One student informs the nearest teacher as to what happened. That teacher will cease all student activity in his/her area and ask a neighboring teacher to cover both classes before reporting to the injured teacher's class.

   b. While the above is being done, simultaneously another student informs the nurse.

   c. Another student informs the department head and/or the principal.

6. The student lab manager controls the class while help is arriving.

7. The students should abide by all instructions from the first staff member arriving on the scene.

8. The first staff member on the scene:

   a. Directs students to report to a holding area with supervision.

b. Comforts and assists injured teacher as nature of injury dictates until medical help arrives.

c. If nurse arrives before an administrator, the teacher remains on the scene.

d. When the department head or other administrative member arrives, the teacher returns to his/her class.

9. The department head:

a. Makes arrangements with the administration to provide supervision of the assigned students for as many periods as it will take to handle the emergency and to carry out fact-gathering procedures.

b. Obtains information about the accident from injured teacher.

c. Keeps laboratory closed for appropriate time period.

d. If equipment is involved, ascertains that equipment is placed "out of service."

e. Prepares report as per school and state policy.

General First Aid

It is important that all industrial arts education teachers become familiar with immediate first aid procedures. (An excellent reference is the book entitled, Advanced First Aid and Emergency Care, published by the American Red Cross.) Teachers should also develop an understanding of their legal limitations when administering first aid, which generally is:

1. The only medical aid given should be to prevent the student from receiving further injury.

2. In most cases, the responsibility for first aid rests with the chief medical officer, namely the school nurse, therefore, when a student injury occurs, the school nurse should be immediately notified.

The local school district should make available, to the industrial arts education teachers, written first aid procedures to follow in the event of an accident occurring causing injury to a student. Among the injuries to be covered are:

1. Abrasions
2. Asphyxiation
3. Back injuries
4. Bee stings
5. Bleeding from ears, nose, throat, lungs, and stomach
6. Blisters
7. Burns of the skin, eye
8. Convulsions
9. Cuts
10. Diabetes
11. Dislocations
12. Eye injuries
13. Fainting
14. Fractures
15. Head injuries
16. Injury to teeth

17. Nose bleed
18. Nausea and vomiting
19. Rashes
20. Splinters
21. Sprains
22. Signs and symptoms requiring further examination and referral to Health Services

It may also be necessary for the instructor to become familiar with first aid procedures to follow when students have:

1. Suspected communicable disease
2. Elevated temperature

Secondary Concerns

After the injured person has been administered to by professionals (nurse, ambulance crew, or doctor), the actions of the teacher should focus on the secondary concerns. (These procedures should also be followed for "near miss" incidents to assure that the conditions which nearly caused an injury are corrected.) These concerns are: control of the remaining students and the necessary follow-up procedures in regards to the injury.

Action is necessary in the following areas:

1. Calm other members of the class. Restore the situation to a safe environment. If the accident was serious, instruction may have to be discontinued for the period. The students may be too upset to perform effectively and may in fact be accident-prone due to anxiety.
2. Complete accident report.
3. Analyze cause of the accident and make written recommendations to the administration for corrective measures to be taken.
4. Retain copies of all reports made for verification purposes.
5. Review safety practices, procedures and instructions related to the accident.
6. Check on the results of the treatment to the injured student.
7. Provide follow-up instruction for the class regarding safety practices that may have been violated, thereby contributing to the accident.
8. If faulty equipment was the cause of the injury, it is suggested that:
   a. The equipment be taken out of service.
   b. An "out of service" sign be posted on machine.
   c. The proper administrator contact company that services equipment to examine machine and correct any possible defects.

d. The unit be put back into use only after inspection and clearance from the service company, insurance carrier, and/or the administration.

## Role of Substitutes

Due to the variety of equipment and supplies for which a laboratory teacher is responsible, it is essential to consider the role of a substitute teacher. Consideration should first be given to the amount of time that the regular teacher will be absent. The next consideration is whether the substitute teacher is certified in that laboratory instructional area or not.

At no time should a noncertified substitute be permitted to instruct or permit students to work in the laboratory.

If the substitute is certified, the following actions may be taken:

1. Brief Absence. If the regular teacher is on a brief absence, it is recommended that the substitute not hold class in the laboratory. The regular teacher should leave alternate plans which can be carried out in a regular classroon (not in the laboratory area).

2. Extended Absence. If the regular teacher will be absent for a long duration, it is recommended that a substitute may teach and conduct class in the laboratory after:

   a. the department head or principal reviews the situation with the substitute and is satisfied that the substitute is knowledgeable of that area and its related equipment.

   b. the administration gives approval.

   Note: If a substitute is allowed to teach in the laboratory, it is strongly recommended that constant supervision be provided by the department head and/or administration.

## School Accident Reporting

When any industrial arts education laboratory accident occurs, it must be reported since this indicates corrective action may be necessary.

It is recommended that school districts use two student accident reporting forms. One is the required State Accident Reporting Form, MIS 07D007 (Appendix B). The other is a school form (Figure 2) which should be completed by the involved teacher and filed with the proper school administrator within 24 hours of the accident. The school form should be completed in triplicate. The original form to be submitted to the administrator, one copy to be sent to the Health Services office, and the second copy to be retained by the teacher.

New Jersey law requires that the Accident Reporting Form, MIS 07D007, be sent to the Division of Vocational Education and Career Preparation within five working days of the occurrence of the accident.

ACCIDENT REPORT

To: _____, Department Head Date: _____

From: _____ Lab where accident occurred: _____

Name of injured student: _____

Date and time of accident: _____

Brief description of injury: _____

_____

Brief description of how accident occurred: _____

_____

_____

Students working in the area of accident: _____

_____

Instructor's signature: _____

==========

Steps taken to prevent a similar accident: _____

_____

Figure 2. School Accident Report Form

# GENERAL INDUSTRIAL ARTS SAFETY EDUCATION POLICY

## GENERAL INDUSTRIAL ARTS SAFETY EDUCATION POLICY

### Foreword

It is a recognized fact that school shop laboratories can be potentially dangerous places in which to work. A properly equipped, arranged, maintained, and managed facility can provide a safe environment, thereby reducing the element of danger. Industrial arts teachers have the responsibility of maintaining a diversity of equipment for safe and productive operation. The teachers are also responsible for the development and maintenance of a persistent, positive safety attitude on behalf of students and themselves.

Accidents can be prevented through an effective safety program. A program that thinks safety, talks safety, and practices safety cannot help but succeed. Safety must be a day-to-day ongoing program, if it is to be effective. This section will provide the policies needed to insure consistency and continuity of a safety program.

### Essentials of a Safety Education Program

The essential elements of a safety education program are:

1. General and specific machine safety instruction must be established and made available to the students at all times.

2. Evidence must be established that proves each student received safety instructions, and has been tested to ascertain student's knowledge of safety.

3. The written examination to ascertain the student's knowledge of safety should be documented with the date and student's signature (Appendix I).

4. The teacher must demonstrate to each student, individually or in groups, the proper and safe operation of all shop machinery and record the instruction date in the plan book.

5. Each student must demonstrate to the teacher the ability to use shop machinery safely, with the date of the demonstration recorded.

6. All tests and other forms of evidence of safety instructions should be kept on file as long as the student is enrolled in school.

7. All reports or other evidence of an accident should be kept in a safe place on school property to be available in case of future litigation.

8. Attendance records must be maintained.

### Teacher's Safety Code of Ethics*

I am aware of the job safety requirements in my areas of supervision.

I inspect each major, minor, and "almost" accident.

I search, scrutinize, and determine methods to prevent and control accidents.

I am acquainted with the standards and requirements for personal protective equipment.

I make known to students the purpose of personal protective equipment.

I train my students in fire prevention and control.

I inform students of the need for good housekeeping as a safety and fire prevention tool.

I relate to my students how the safety laws are designed to prevent accidents and injuries.

I use visual aids to illustrate safety procedures and equipment to my students.

I use various teaching methods to demonstrate safety awareness.

I use negative and positive teaching techniques to reinforce job safety procedures.

I test the students to determine how well I am teaching safety.

I evaluate myself to ascertain how fully I meet the requirements of safety on-the-job supervision.

I make it a practice to give a safety tip on each job once a week to the students.

I keep up-to-date with safety requirements.

*Taken from New Jersey State Department of Education, Safety Manual for Cooperative Industrial Education.

## Causes of Accidents

The possibility of student injury weighs heavily upon the conscience of dedicated industrial arts education instructors. A well-organized safety program should be an integral part of every course offering. Prevention of many accidents can be achieved by reducing the human and environmental causes of accidents.

Human and environmental causes of accidents in the school's industrial arts education laboratories are as follows:

1. Human causes
    a. Ignorance
    b. Carelessness
        1. Overconfidence
        2. Loss of interest

3. Fatigue, due to:
    aa. Continuous work without rest
    bb. Monotony of motion
    cc. High speed
    dd. Unnecessary motions
    ee. Poor seating
    ff. Poor physical conditions
        1. Light
        2. Heat
        3. Ventilation

c. Wrong attitude toward safety
d. Diverted attention
e. Irresponsible behavior

2. Environmental causes
    a. Unsatisfactory handtools
        1. Wrong size
        2. Wrong kind
        3. Dull
        4. Without proper handles
        5. Worn
    b. Unsatisfactory machines
        1. Insufficiently spaced
        2. Unguarded
        3. Broken
        4. Improperly adjusted
        5. Insufficiently lubricated
        6. Too small
        7. Dull cutting edges
    c. Physical condition of student
        1. Posture
        2. Eyesight and hearing
        3. Unkept hair
        4. Jewelry (rings, necklaces, etc.)
    d. Student's shop clothing
        1. Inappropriate for the work
        2. Poor condition
        3. Loose or flowing parts
    e. Dangerous materials
        1. Sharp edges
        2. Improperly placed
        3. Flammable
        4. Poisonous
        5. Temperature extremes
    f. Dangerous conditions
        1. Exposed conductors of electricity
        2. Holes in floor
        3. Projecting objects
        4. Slippery floors
        5. Lack of safety lanes to travel

## Teacher Liability in School Shop Accidents

The subject of teacher liability due to a school-related accident is extremely broad, oftentimes complex, and legally very technical. The following information, therefore, is not to be construed as the "bible" on teacher liability. Its intent is to expose the teacher to some basic general teacher liability facts.

New Jersey is unique in that it has a "save harmless" clause in its school laws that limits the liability of a teacher. New Jersey Statutes 18A:16-6 states:

> Indemnity of officers and employees against civil actions. Whenever any civil action has been or shall be brought against any person holding any office, position, or employment under the jurisdiction of any board of education, including any student teacher, for any act or omission arising out of and in the course of the performance of any duties of such office, position, employment, or student teaching, the board shall defray all costs of defending such action, including reasonable counsel fees and expenses, together with costs of appeal, if any, and shall save harmless and protect such person from any financial loss resulting therefrom, and said board may arrange for and maintain appropriate insurance to cover all such damages, losses, and expenses.

This means that New Jersey teachers will not suffer financial losses due to school-related accidents, but it does not insure loss of employment. An act of negligence may bring about actions culminating in job loss. It behooves every teacher to become more knowledgeable about the subject of negligence and liability.

It is highly recommended that teachers read the following publications for a better understanding of this complex area:

1. Kigen, D., Teacher Liability in School-Shop Accidents. Ann Arbor, Michigan: Prakken Publications, 1973.

2. Kigen, D., & Sherick, A., "Shop Teachers Liabilities" in M.E. Strong (Ed.), Accident Prevention Manual for Training Programs. Chicago: American Technical Society, 1975.

## Avoiding Negligent Behavior

Teachers should constantly address themselves to the subject of negligence not only as an obligation to themselves but as an obligation to protect the students in their care. A few recommendations for avoiding negligent practices are as follows:

1. Supervise students to prevent them from causing injury to themselves or from causing injury to others.

2. Instruct students in proper manner of conducting inherently dangerous activities. Emphasize and periodically review all safety procedures.

3. Warn students of the specific dangers inherent in each shop/classroom activity.

4. Keep machinery in proper working order, especially the safety devices. If a machine is defective, do not use it. Render it inoperable and inform administration in writing of the unsafe condition.

5. Use discretion in the selection of participants for activities not under direct personal supervision.

Shop Laboratory Practices Leading to Liability of Teachers and Suggested Remedial Tactics

| Practice | Remedial Tactic |
|---|---|
| Teachers leaving the industrial arts education shop when students are working therein. | 1. Never leave the shop while students are working in the shop.<br>2. Have a clear understanding with the principal and/or supervisor that teachers are not to be called from the shop during class sessions.<br>3. Only under extreme conditions should teachers absent themselves from the shop. When this occurs, the main switch box should be locked, and a sedentary or reading assignment should be given to students. |
| Teachers leaving the shop under the supervision of a teacher who is not qualified to teach industrial arts subjects. | 1. Do not permit substitute teachers to teach in a shop unless they are qualified or certified instructors.<br>2. If no one is available, written or reading assignments, prepared in advance, or some type of sedentary activity, where the students will not be using the machines and equipment in the shop, is in order. Instructional movies or similar aids are practical if they fit into the instructional program. |
| Permitting students not enrolled in the class to use shop laboratory equipment and tools. | 1. Permit only those students who have participated in the shop program, or who are participating, to use the shop and equipment therein.<br>2. No exceptions should be made to this practice.<br>3. Do not take the word of students that they have had previous instruction on the tools or have had experience in their usage. |

| | |
|---|---|
| Permitting students to use machines or tools or to perform activities for which instruction has not been given. | 1. Make sure that proper instruction is given for each basic operation to be performed by a student in the shop class.<br>2. Permit no student to use a machine or tool in performing an operation for which instruction has not been given.<br>3. Keep an accurate instructional log for machines, tools, and operations for which instruction has been given. |
| Permitting students to use equipment in the shop laboratory which has not been approved by the administration and board of education. | 1. Teachers are not to permit students to use teachers' personal tools or equipment in school shop.<br>2. Allow no student to bring in any item of equipment for use in the shop.<br>3. Permit students to use only those items of tools and machines that have been purchased with the approval of the board of education and school administration. |
| Permitting students to work in the shop laboratory during free periods, particularly when the laboratory is not supervised. | 1. Do not leave the shop when students are working, even during unscheduled classes and periods.<br>2. Permit students to use equipment and work in the shop during designated periods when proper supervision is given. |
| Permitting students to use dull tools and/or cutting devices on machines. | 1. Periodically inspect all cutting edges of power tool devices and of hand tools.<br>2. Keep all items of equipment properly maintained and sharpened.<br>3. Demonstrate the proper maintenance and care of cutting edges of hand tools. |
| Permitting students to perform operations on machines without a guard, particularly when one could have been used. | 1. Provide proper instruction for the use and adjustment of guards, emphasizing the necessity and function of such a device.<br>2. Set an example by using guards and safety devices at all times while operating machines.<br>3. Require students to use guards at all times.<br>4. Have students secure permission to use equipment and check to see that guards are properly adjusted. |
| Allowing the use of equipment by students who are prone to accidents or who possess physical disabilities that may cause an accident. | 1. Be familiar with work habits of students and with those who possess physical handicaps which may necessitate restrictions being placed on their use of equipment.<br>2. Require all students to secure permission before using any item of equipment.<br>3. Limit students to the use of machines which are within their capabilities and commensurate with whatever handicap they posses |

| | |
|---|---|
| Sending students outside the shop laboratory to perform activities for the school or other departments. | 1. Do not permit students to leave the shop to perform activities outside the shop area.<br>2. Refuse to undertake projects or jobs that require the students to work away from the shop without continuous supervision of properly certified personnel.<br>3. Confine instructional and maintenance activities to those that can be performed in the shop and are in accordance with the approved course of study. |
| Failing to keep accurate written reports relative to accidents. | 1. Prepare an accident form for the shop laboratory if the school system does not have a standard form.<br>2. Fill out the form as soon as possible after the accident has taken place. Make multiple copies and keep one on file. |
| Failing to secure written statements from witnesses to shop laboratory accidents. | 1. Have a place on the accident report form for the listing of witnesses.<br>2. Have witnesses write, in their own words, their views as to how the accident happened.<br>3. Have witnesses place their signatures to their statements. |
| Failing to administer safety tests to students. | 1. Administer safety tests to students upon completion of the demonstration of a specific machine, tool, or process.<br>2. Keep tests on file as evidence that such material had been covered and that a test was actually administered.<br>3. Set a critical score (usually 100%) which students must achieve in order to use a specific item of equipment. |
| Failing to exercise the utmost caution. | 1. Anticipate where and how an accident may occur and use every means to eliminate the possibility of the accident occurring.<br>2. Make every possible effort to provide the safest physical facilities and implement an effective safety instructional program. |
| "Contributory negligence." | 1. Maintain the safest working conditions in the shop.<br>2. Insist on safe practices being adhered to at all times.<br>3. Provide complete and proper instruction in all aspects of shop work, with regard to the use of tools, machines, and materials.<br>4. Make recommendations to superiors as to changes that can be made to improve safety conditions.<br>5. Make improvements suggested by superiors.<br>6. Establish safety rules and enforce them.<br>7. Organize and implement a complete and continuous safety education program. |

## Policy on Use of School Equipment

The New Jersey Administrative Code, 6:29-5.2(c) (Appendix A), states:

> Shop equipment shall not be used for any purpose other than shop instruction. The shop teacher shall be held responsible for the condition of shop tools and equipment, and shall have full authority for its use for instructional purposes only.

This regulation is self-explanatory. No administrator, teacher, or board of education member can abrogate its meaning. Everyone is expected to abide by its intent.

## Parent/Guardian Awareness

Safety is everyone's business. In a school shop laboratory situation, it is the responsibility of the teacher to instruct and maintain safe practices and to develop a safe environment. It is the student's responsibility to be conscientious, ever mindful of safety, and to realize that irresponsible behavior has no place in the shop. It is the parent/guardian's responsibility to be aware of the imminent danger in laboratory situations and to reinforce good attitudes of safety at home. The parent/guardian letter concerning safety (Figure 3) is constructed for this purpose.

Each teacher should duplicate and distribute the letter to the students, making sure that the acknowledgements are returned signed. A student should not be allowed to perform any tasks without a properly acknowledged parent/guardian awareness letter. It is recommended that each teacher keep these on file for the school year. (The letters should be personalized with parent's/guardian's name, with student's name, and with the department chairperson's or teacher's signature.)

## Specific Teacher Responsibilities for Safety Instruction

To implement some of the functions considered to be teacher responsibilities, the following actions are recommended:

1. A Comprehensive safety program must include an instructional lesson, written safety quiz, instructor's demonstration, and student performance evaluation for each laboratory machine.

2. Teachers should not expect students to use machines, work with tools, fabricate materials, or conduct themselves in a safe and proper manner in the shop unless detailed instruction is given. With proper instruction goes sound example. The instructor must abide by the safety rules at all times.

3. Industrial arts education teachers have the obligation of establishing their own machine performance standards. These standards must be documented in the lesson plans with a copy given to the department head or administration.

4. The teacher has the responsibility of supplying the student with a copy of the general rules for use of equipment commonly found in the indus-

HY KALIBER REGIONAL HIGH SCHOOL
Department of Industrial Arts Education
Anytown, NJ

Dear (Parent/Guardian): Date: _____

(Student's name) is currently enrolled in an industrial arts education shop laboratory course that involves working with and around complex machines during and after school.

For the students' protection and well being, we, as teachers, having the students' best interests in mind, teach the necessary fundamentals of safe procedures in this area of study to prevent any possible accidents. The students not only receive an explanation and demonstration of safe procedures but undergo a written examination of these procedures to further insure their complete learning of safety prior to using laboratory equipment.

From a physical standpoint, eye protection devices are available and must be worn at all times. Face shields must be worn at certain power machines as required by safety practices. The students have been made well aware of the possible results of an accident when proper eye protection is not worn.

New Jersey Vocational Education Safety Standards, New Jersey Administrative Code, Title 6, Chapter 53, requires that students must use proper machine guards at all times. Students have been advised that irresponsible behavior of any sort will not be tolerated.

Students have been told that they must inform the teacher of any injury, regardless of how slight, at the time of the injury.

Our shop laboratories are modern and equipped with high quality equipment that requires the utmost caution at all times. It is our intention that you will share the same interest for your child's well being as we do. Will you kindly sign the lower section of this sheet signifying that you are aware of our procedures, and return it to us.

Thank you,

(Signature)
Industrial Arts Department Chairperson

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This is to indicate that I am aware that my child is expected to adhere to the prescribed rules of safety while in the school shop laboratory classes and that he/she has been instructed as to the possible results of infractions. Furthermore, I realize that my child is subject to disciplinary action for failure to comply with these rules which could possibly include dismissal from class.

(Signature of parent/guardian) (Date)

Figure 3. Letter to Parent/Guardian

trial arts education shop laboratory. The rules should be as specific as deemed necessary. These should be approved by the department head or administration.

5. The teacher should conduct a separate lesson for each specific machine, tool, or piece of equipment and record, in the plan book, the date it was given. It is also recommended that the date of the lesson demonstration be recorded on the form for recording machine safety and performance tests, the Student Machine Use Evaluation Record (Figures 4-9).

6. The teacher has the responsibility for developing and administering a written safety test to be completed by each student. Copies of the tests should be approved by the department head or administration and noted in the plan book. Students should attain a perfect score before they can proceed to use equipment in the shops.

7. Students should not be allowed to operate laboratory machines or tools unless they have successfully passed both the written and performance standards of the program.

8. The dates of the instructor's demonstration and student's successful test performance should be filed and kept by the instructor until the student has graduated from school. These forms should be made readily available to the department head or administration, if ever needed, as evidence that proper instruction was provided.

STUDENT MACHINE USE EVALUATION RECORD

Hy Kaliber Regional High School
Department of Industrial Arts Education

ELECTRICITY AND ELECTRONICS

_____
Teacher

_____ has been given the proper demonstration, has passed the required safety exams, and is, therefore, permitted to use the following items according to the accepted safety procedures:

| Equipment | Date | | |
|---|---|---|---|
| | Teacher Demonstration | Written Test Passed | Performance Test Passed |
| Band Saw | | | |
| Drill Press | | | |
| Electric Hand Drill | | | |
| Hand Tools | | | |
| Notcher | | | |
| Oscilloscope | | | |
| Pan Break | | | |
| Shear | | | |
| Solder Iron (Electric) | | | |
| Solder Iron (Gas Heated) | | | |
| V.O.M. | | | |
| V.T.V.M. | | | |
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Figure 4. Student Machine Use Evaluation Form (Electricity and Electronics)

STUDENT MACHINE USE EVALUATION RECORD

Hy Kaliber Regional High School
Department of Industrial Arts Education

GENERAL SHOP

_____
Teacher

_____ has been given the proper demonstration, has passed the required safety exams, and is, therefore, permitted to use the following items according to the accepted safety procedures:

| Equipment | Date | | |
|---|---|---|---|
| | Teacher Demonstration | Written Test Passed | Performance Test Passed |
| Band Saw | | | |
| Belt Sander | | | |
| Disc Sander | | | |
| Drill Press | | | |
| Electric Hand Drill | | | |
| Finishing Sander | | | |
| Grinder | | | |
| Hand Tools | | | |
| Jig Saw | | | |
| Jointer | | | |
| Metal Lathe | | | |
| Oxy-Acetylene Welder | | | |
| Portable Belt Sander | | | |
| Router | | | |
| Sabre Saw | | | |
| Sheet Metal Machines | | | |
| Spot Welder | | | |
| Table Saw | | | |
| Wood Lathe | | | |

Figure 5. Student Machine Use Evaluation Form
(General Shop)

STUDENT MACHINE USE EVALUATION RECORD

Hy Kaliber Regional High School
Department of Industrial Arts Education

GRAPHIC ARTS

_____
Teacher

_____ has been given the proper demonstration, has passed the required safety exams, and is, therefore, permitted to use the following items according to the accepted safety procedures:

| Equipment | Date | | |
|---|---|---|---|
| | Teacher Demonstration | Written Test Passed | Performance Test Passed |
| Folding Machine | | | |
| Offset Press | | | |
| Paper Cutter | | | |
| Paper Drill | | | |
| Pilot Press | | | |
| Platen Press | | | |
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Figure 6. Student Machine Use Evaluation Form (Graphic Arts)

STUDENT MACHINE USE EVALUATION RECORD

Hy Kaliber Regional High School
Department of Industrial Arts Education

METALS

_____
Teacher

_____ has been given the proper demonstration, has passed the required safety exams, and is, therefore, permitted to use the following items according to the accepted safety procedures:

| Equipment | Date | | |
|---|---|---|---|
| | Teacher Demonstration | Written Test Passed | Performance Test Passed |
| Band Saw | | | |
| Diacro Bender | | | |
| Disc Sander | | | |
| Drill Press | | | |
| Electric Hand Drill | | | |
| Forge Furnace | | | |
| Gas Burner | | | |
| Grinder | | | |
| Hand Tools | | | |
| Hole Punch Press | | | |
| Lathe | | | |
| Melt Furnace | | | |
| Milling Machine | | | |
| Notcher | | | |
| Pan Break | | | |
| Power Hacksaw | | | |
| Propane Tank | | | |
| Shear | | | |
| | | | |

Figure 7. Student Machine Use Evaluation Form (Metals)

STUDENT MACHINE USE EVALUATION RECORD

Hy Kaliber Regional High School
Department of Industrial Arts Education

POWER MECHANICS

_____
Teacher

_____ has been given the proper demonstration, has passed the required safety exams, and is, therefore, permitted to use the following items according to the accepted safety procedures:

| Equipment | Date | | |
|---|---|---|---|
| | Teacher Demonstration | Written Test Passed | Performance Test Passed |
| Air-Driven Tools | | | |
| Arc Welder | | | |
| Battery Charger/Tester | | | |
| Brake Bleeder | | | |
| Degreaser | | | |
| Drill Press | | | |
| Electric Hand Drill | | | |
| Grinder | | | |
| Hand Tools | | | |
| Hole Punch Press | | | |
| Hydraulic Jack | | | |
| Lathe | | | |
| Ony-Acetylene Welder | | | |
| Paint Sprayer | | | |
| Portable Disc Sander | | | |
| Radiator Test Tools | | | |
| Solder Iron (Electric) | | | |
| Spark Plug Cleaner | | | |
| Valve Seat Grinder | | | |

Figure 8. Student Machine Use Evaluation Form
(Power Mechanics)

STUDENT MACHINE USE EVALUATION RECORD

Hy Kaliber Regional High School
Department of Industrial Arts Education

WOODS

_____
Teacher

_____ has been given the proper demonstration, has passed the required safety exams, and is, therefore, permitted to use the following items according to the accepted safety procedures:

| Equipment | Date | | |
|---|---|---|---|
| | Teacher Demonstration | Written Test Passed | Performance Test Passed |
| Band Saw | | | |
| Belt Sander | | | |
| Dremel Tool | | | |
| Drill Press | | | |
| Electric Hand Drill | | | |
| Grinder | | | |
| Hand Tools | | | |
| Jointer | | | |
| Lathe | | | |
| Oscillating Sander | | | |
| Portable Belt Sander | | | |
| Router | | | |
| Sabre Saw | | | |
| Scroll Saw | | | |
| Surface Planer | | | |
| Table Saw | | | |
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Figure 9. Student Machine Use Evaluation Form (Woods)

## Repair Request

In order to prevent accidents, it is imperative that the shop-laboratory teacher report, in writing, to the proper authority (Supervisor, Principal) any unsafe condition as soon as the condition is detected. The written notice, in the form of a repair request (Figure 10), should be completed in duplicate so that a copy may be kept by the teacher.

REPAIR REQUEST

TO: _____ Date _____

FROM: _____ Room # _____

RE: _____

Remedy to be completed by (date) _____

General description of repair/improvement: _____

_____

_____

Description of machine or part (Make, Model, Size, etc.): _____

_____

Following action has been taken by teacher:

Equipment tagged "Out of Order" _____
date time

Students warned not to use the equipment. _____
yes no

Instructors sharing room informed of the problem. _____
yes no

This request is a follow-up to a previous request. _____ _____
yes date no

---

Action taken: _____

_____

Figure 10. Sample Repair Request Form

## Safety Inspections

Safety is a continuous, concentrated effort. Safety inspections will help keep the facilities and personnel safety-oriented. It is recommended that a check list (Appendix J) be used to assure that all safety factors are examined during safety inspections.

Inspections of school laboratories may be classified as follows:

1. Periodic inspections -- These are performed by teachers or supervisors on a regularly scheduled (weekly, monthly) basis.

2. Intermittant inspections -- These are performed by the teachers or supervisors at irregular intervals, as needed. An unusual number of accidents may be the catalyst for this type of inspection.

3. Continuous inspections -- These are performed by students assigned by the teacher to check some equipment or practice. This is done to make students constantly aware of the importance of safety.

3. Special inspections -- These are performed, at least once a year, by the school safety committee; school personnel (state and/or local level); student safety committee; insurance safety engineers; inspectors from the State Department of Education; state fire inspectors; local fire department; local manufacturers of equipment, tools, and supplies; utility companies; the Red Cross; and/or the National Safety Council. These are generally in-depth inspections.

End-of-Year Shop Checkout

It is recommended that all teachers use a check list (Appendix K) as an end-of-year checkout guide to be certain that all safety-related items are accounted for prior to "closing" the laboratory. This should be completed by the beginning of June so that the department head or a school administrator can have ample time to review the reported status of each item. (Some items will obviously be completed on the last day of the school year.)

Safety Educational Aids

The use of educational aids will enhance any school safety education program. They will allow teachers to individualize their program efforts. Students will be motivated as well as kept interested in the program by varying the instructional techniques.

Safety education programs may be emphasized through the use of:

1. Posters--which should be attractive, prominently displayed, and frequently changed.

2. Slogans--which will get the message across every time a student is confronted with the printed slogan on bulletin boards or wherever notices are placed.

3. Rules--which should be posted on each machine, for that machine, or posted in the immediate proximity to that machine.

4. Motion pictures--which should be relevant and timely to the instruction. (The National Safety Council publishes a bulletin listing hundreds of safety-related films.)

5. Books and magazines--which should be maintained on safety subjects in the laboratory and/or in the school library. (Membership in the National Safety Council will provide a means of keeping up-to-date on all aspects of safety and is the source of relevant safety literature.)

# SAFETY STANDARDS

## Facility Considerations

School laboratory facilities are important elements in any educational safety program. They must be properly maintained, with provisions made for the protection of their users, to contribute to the total educational safety program.

Maintaining a safe working environment includes, among other considerations, having an attractive and purposefully painted laboratory, a laboratory with sufficient space in which to work, a laboratory with proper materials on which to stand while working, a laboratory with appropriate illumination and ventilation, a laboratory with sufficient and safe storage areas, a laboratory with proper fire prevention and control equipment, a laboratory with electric service that is adequate and has been properly safeguarded, a laboratory wherein the noises are kept to reasonable levels, a laboratory where personal protection devices are provided and used, and a laboratory where students, teachers, and other school personnel cooperate in keeping the building, equipment, and people in a safe and sound condition.

## Color Coding

Color coding is the use of colors to paint walls, floors, and equipment to create a safe environment. It will help make students aware of dangerous machine parts, physical hazards, equipment under repair, fire equipment, etc. Color coding creates an attitude for a safe environment by painting traffic lanes on floors that are similar to traffic lanes on the highways, by using color-coded safety signs to keep safety ever present in the viewer's psyche, by using colors that psychologists have found to be effective in establishing various moods in people.

Some colors and their suggested uses are as follows:

| | |
|---|---|
| Red | Emergency stop switches<br>Fire alarm boxes<br>Fire extinguishers<br>Fire blanket containers<br>Fire hose cabinets<br>Fire exit signs<br>Fire sand pails<br>Cans/cabinets containing flammable material (contents labeled in White) |
| Yellow | Parts of machines that move, adjustment levers/handles, wheels, knobs<br>Parts of equipment that move<br>Handrails/guardrails<br>Vertical edges of platforms/steps |
| Blue | Outside of large switch boxes |

| | |
|---|---|
| Green | First aid kits (with White Cross)<br>Bulletin boards for safety information<br>Safety showers<br>Eye wash stations<br>Stretcher location |
| Orange | Exposed edges of pulleys, gears, rollers, power operated jaws<br>Parts of a machine that crush, cut, shock<br>Guards that cover blades<br>Inside of fuse/curcuit breaker boxes<br>Machine switch box covers<br>Inside of all switch boxes |
| Yellow & Black (Diagonals) | Low overhead beams or other obstacles<br>Parts of machine that stick out, edges of tables, rear of shaper arm<br>Safety zones around equipment<br>Outline of traffic lanes |
| Ivory/Buff | Vertical edges of all tables and benches<br>Background where instruments are used |
| Non-gloss Pale Blue/Green/Gray | All equipment<br>Body of all machines<br>Walls |

With the adoption of a uniform safety color code the students should be given instructions as to the meaning of the colors. Thus, reactions to any sudden emergency will be spontaneous and as the students move from laboratory to laboratory, the colors will be uniform and provide for a continuity of the safety attitude.

## Safety Signs

Signs play an important role in maintaining an attitude of safety consciousness. They should be correctly color-coded and displayed. Five signs appropriate for industrial arts education, as recommended by the American National Standards Institute in their "Specifications for Accident Prevention Signs, Z 35.1-1972," are as follows:

1.


Danger signs shall have a white background. Word "DANGER" shall appear in white letters on a red oval inside a black rectangular panel. Sign wording should be black letters on white background. Danger signs should be used only where an immediate hazard exists.

2.

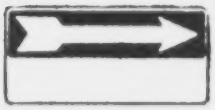

Caution signs shall have a yellow background. Word "CAUTION" shall appear in yellow letters on black rectangular panel. Sign wording should be in black letters on yellow background. Should be used only to warn against potential hazards or to caution against unsafe practices.

3.


Safety Instruction signs (fire drill instructions, etc.) should have a white background. If such wordings as "THINK" or "SAFETY FIRST" are used, they should be white letters on a green rectangular panel. Sign wording should be in black letters on the white background. Should be used for general instructions relative to safety measures.

4.


Basic information signs may be of a variety of designs and colors, except that neither red nor yellow shall be used. They convey information not necessarily of a safety nature, but primarily to avoid confusion and misunderstanding.

5. 

Directional signs shall have a white background. The "ARROW" should be in white on black panel. Wording on arrow or below panel should be in black. Used to indicate way to locations: exits, fire escapes, stairways, first aid room, etc.

Floor Areas

Unsafe floors contribute to such hazards as slipping, tripping, stumbling, and falling. The following recommendations should be considered when designing, selecting, and maintaining shop laboratory flooring:

1. Floor surfaces must be level, except in areas where drainage may be necessary.
2. In areas where fire and extreme heat are factors, fireproof flooring is mandatory.
3. In the foundry area, pouring should be done on a dry sand floor area.
4. A nonskid material should be applied to the floor where the operator stands.
5. Aisles should be sufficiently wide and kept clear at all times. Recommended width is 48", minimum distance is 36".
6. Floors must be kept clear of all foreign materials which could cause falls. Immediate cleanup of spills will help to prevent accidents.
7. Care should be taken not to allow concrete floors to become slick.
8. Floors should be thoroughly cleaned periodically to eliminate accumulations of dirt, dust and grease.
9. Sufficient open floor spece should be provided to prevent crowding and interference among students around all doorways, in project assembly areas, demonstration areas, around tool cribs and tool panels and near material storage areas.

10. Machines that are more than four feet in height should be placed near laboratory walls so that visibility will not be obstructed.

11. Safety zones should be painted with yellow and black stripes around machines to provide ample work space and to prevent interference with the operator.

12. All traffic lanes should be outlined in 3" wide yellow and black stripe lines.

## Floor Materials

The selection of flooring material should vary with the requirements of the specific shop laboratory and the anticipated work to be performed (Table 1). The range of available flooring materials is sufficient for making a proper selection. Vinyl, vinyl asbestos tile, concrete, hardwood, brick tile, slate, ceramic tile, terrazzo, and carpeting are among the most widely used materials. of these materials, four are generally used in industrial arts education laboratories - solid hardwood block, vinyl, vinyl asbestos tile, and concrete.

TABLE 1

FLOORING MATERIALS RECOMMENDED FOR USE IN INDUSTRIAL EDUCATION FACILITIES

| Laboratory or Auxiliary Area | Recommended Flooring Material |
|---|---|
| General Shop | Maple |
| Woods | Maple |
| Metals | Concrete |
| Crafts | Maple |
| Graphic Arts | Maple, Vinyl Asbestos, Vinyl, Concrete |
| Electricity/Electronics | Maple, Vinyl Asbestos, Vinyl |
| Drawing | Maple, Vinyl Asbestos, Vinyl, Concrete |
| Automotive Technology | Concrete |
| Class Area | Maple, Vinyl Asbestos, Vinyl, Carpet |
| Teacher's Office | Maple, Vinyl Asbestos, Vinyl, Carpet |
| Design Center | Maple, Vinyl Asbestos, Vinyl, Carpet |
| Laboratory Library | Maple, Vinyl Asbestos, Vinyl, Carpet |
| Demonstration Area | Same as main work area |
| Locker Area | Same as main work area |
| Project Storage Room | Same as main work area |
| Materials Storage Room | Same as main work area |
| Equipment Storage Room | Same as main work area |
| Project Assembly Room | Same as main work area |
| Toilet and Lavatory | Terrazzo, Ceramic tile |
| Wash Area | Same as main work area |
| Finishing Room | Concrete |
| Darkroom | Concrete, Vinyl Asbestos, Vinyl, Carpet |
| Materials Testing Center | Maple |

Note: From R.D. Brown, Industrial Education Facilities. Boston: Allyn and Bacon, 1979, p. 115. Reprinted with permission.

## Class Size and Shape Recommendations

Crowded laboratories create hazards, invite disciplinary problems and hinder educational progress. The relationship between class size and safety has always been a concern of industrial arts education teachers because of the power machinery environment. The State of New Jersey, Department of Education, Division of Vocational Education and Career Preparation has suggested facility capacity standards (Appendix F) that are used herein as the safety education program's recommendations.

The State suggests a capacity of 20 students for all areas except drafting, where the capacity is set at 24 students. Maximum capacity is based upon a minimum square footage of instructional area per student. Following are the suggestions concerning square footage:

| Facility | Square Feet of Instructional Area per Student |
|---|---|
| Drafting | 50 |
| Electricity/Electronics | 90 |
| General Shop | 140 |
| Graphic Arts | 120 |
| Metals | 120 |
| Power-Automotive | 140 |
| Woods | 120 |

If the actual enrollment in the specific facility exceeds the suggested number, based on the recommended square footage per student, the number of students in any one class should be reduced accordingly.

Any shape that does not allow an instructor full visibility of the entire area at all times should be avoided. It is suggested that a rectangular room, with a proportion ratio of 1:2, be used because it generally lends itself to a suitable arrangement of machines and equipment. Proportions of 1:1, 1:1.5, and 1:3 may also be used if availability of space is a consideration. Irregularly shaped rooms, such as U, L, or T-shapes, should be avoided.

## Illumination

Lighting, whether natural, incandescent, or flourescent, should furnish the quantity and quality of illumination necessary to permit safe and efficient task performance. If industrial arts education students are to learn well, they must be able to see what they are doing and what is going on in the class around them.

Although the Illuminating Engineering Society has suggested 70 foot candles for laboratory areas and 100 foot candles for drafting areas as minimum requirements, it is recommended (Table 2) that higher levels of illumination be provided in industrial arts education laboratories than in other educational facilities. The higher levels are achievable and practical in terms of cost and teacher/student needs.

TABLE 2

RECOMMENDED MINIMUM LEVELS OF GENERAL ILLUMINATION

| Type of Facility | Footcandles at a Working Surface[a] |
|---|---|
| Laboratories | |
| Drawing | 200 |
| Metals | 150 |
| Woods | 150 |
| Crafts | 200 |
| Automotive Technology | 150 |
| Graphic Arts | 150 |
| Electricity/Electronics | 200 |
| General | 150 |
| Auxiliary Areas | |
| Design Center | 200 |
| Class Area | 150 |
| Teacher's Office | 150 |
| Demonstration Area | 150 |
| Laboratory Library | 150 |
| Student Locker Area | 30 |
| Project Storage Room | 50 |
| Materials Storage Room | 30 |
| Equipment Storage Room | 50 |
| Project Assembly Area | 150 |
| Toilet and Lavatory Room | 30 |
| Wash Area | 30 |
| Finishing Room | 150 |
| Darkroom | 50 |
| Materials or Equipment Testing Room | 150 |

[a] Considered to be thirty inches above floor level.
Note: Taken from R.D. Brown, Industrial Education Facilities. Boston: Allyn and Bacon, 1979. Reprinted by permission.

A survey of shop laboratories, using the recommended minimum levels as a guide, will help determine whether sufficient lighting is being provided. During the survey, one should also consider the recommendation (N.J.A.C. 6:22-4.11 Lighting intensity, quality, and safety) that the minimum light intensity at work level should not be less than 70% of the maximum light intensity of the instructional area.

In providing light for shop laboratories, consideration must also be given to reflection and glare. All reflectors, lamps, and lighting devices, either individual or general, must be kept clean, properly adjusted, and maintained in a good operable state. Individual lighting (supplying light to a specific area) should be avoided if general lighting will serve the purpose.

Glare has been the direct cause of many accidents, therefore, it should be eliminated. In the industrial arts education laboratories, reflective glare can be eliminated by the proper use of blinds, shades, matte surfaces, lamp shielding, and the use of diffusing or refracting materials.

## Ventilation

Ventilation or exhaust systems are used to remove harmful impurities, to control excessive heat or cold, to regulate humidity or dryness, and to provide a sufficient air supply. Adequate ventilation can also reduce accidents by:

1. removing waste materials that are sources of fires and explosions.
2. reducing slippage through removal of dust and waste materials from the floor.
3. removing dust particles in the air and thereby increasing visibility.

Industrial arts education laboratories require dependable ventilation. To accomplish this, mechanical systems incorporating blowers, fans, and filters should be used.

The New Jersey Administrative Code, Section 6:22-5.2 states that all school buildings must be equipped with mechanical air supply and exhaust ventilation systems. During periods of occupancy of the industrial arts education laboratories, the system must provide a minimum amount of outdoor air supply and exhaust air movements.

TABLE 3[a]

MECHANICAL VENTILATION REQUIREMENTS[b]

| Laboratory | Outdoor Air Supply | General Exhaust | Capacity[c] |
|---|---|---|---|
| Automotive | 360 CFM/room | 400 CFM/room | 1.75 |
| Graphics | 360 CFM/room | 400 CFM/room | 1.75 |
| Metal | 360 CFM/room | 400 CFM/room | 1.75 |
| Wood | 360 CFM/room | 400 CFM/room | 1.75 |
| Drafting | 0.15[c] | 0.15[c] | 1.25 |
| Electricity/ Electronics | 0.15[c] | 0.15[c] | 1.25 |

[a] Reference NJAC 6:22-5.2(a)

[b] Refer to Appendix D for additional requirements

[c] Cubic Feet Per Minute (CFM) for each square foot of floor area

Special consideration should be given to ventilation requirements for welding, foundry, forging, heat treating, machining cast iron, machine woodworking, auto mechanics, plastics forming and grinding, electroplating, etching, painting, and making blueprints. For many of these areas specially designed hoods and venting systems are required.

## Material Handling

Thirteen percent of all reported 1978-79 school accidents in New Jersey were attributed to improper material handling and storage. Material handling in industrial arts education is defined as the traveling material must take from raw stock storage through processing to final product.

In order to minimize material handling accidents, the instructor should evaluate the movement of materials in the laboratory. Efforts should center around easing traffic congestion, avoiding the accumulation of material around machines, and the efficient utilization of laboratory working space. There is less chance for an accident to occur when the movement of materials is continuous. The elements of materials flow control are:

1. Keep the material moving uniformly through each step of the process.
2. Analyze, then minimize, any unnecessary rehandling of material.
3. Eliminate any heavy manual lifting.
4. Whenever possible, reduce the distance that the material has to be transported.
5. Provide special handling equipment whenever it is practical to do so.

Along with the techniques for flow control of materials, consideration should be given to the following suggestions:

1. Materials to be moved horizontally should not be lowered if they are expected to be raised later.
2. Materials taken from storage should be delivered at the proper height for the first process.
3. A proper lifting system should help eliminate future countless lifts.
4. Vertical lifting and carrying of heavy objects can be eliminated by substituting methods whereby the material can be pulled, pushed, or rolled.
5. When carrying material, clear vision over the load is mandatory.
6. Good housekeeping is important whenever objects have to be moved, therefore, traffic areas must be kept clear.
7. Heavy or awkward loads require two or more persons to lift them safely. When using teamwork, persons should be similar in height and physique. They must also coordinate their actions and motions to avoid any unnecessary burden upon either one.

## Lifting Heavy Objects

Individual lifting capabilities vary with a person's physical condition, build, and stature. The National Safety Council recommends the following procedure for lifting heavy objects, regardless of the person's physical condition (Figure 11):

1. Part your feet so that one foot is alongside the object to be lifted and the other is behind.
2. Crouch close to the object and keep your back straight, nearly vertical.
3. Tuck in your chin so that your neck and head continue the straight-back line. (This position helps keep your spine straight and firm.)
4. Grip the object firmly with both hands. Use the palms of your hands as well as your fingers.
5. Draw the object close to you and tuck your arms and elbows close to your body.
6. Position your body so that its weight is centered over your feet. Start the lift by pushing on your rear foot as you straighten up.

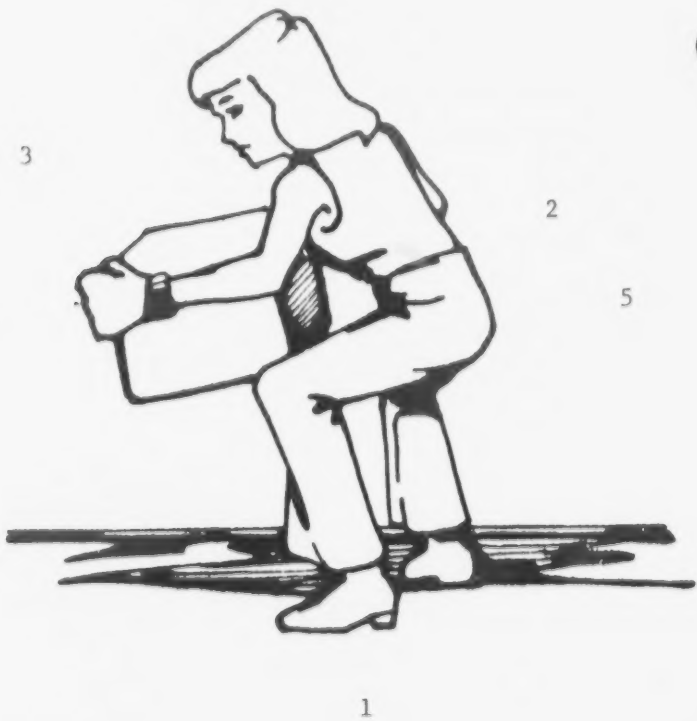



Figure 11. Lifting Heavy Objects

## Handling Chemicals

Chemical use in laboratories requires appropriate precautionary measures to reduce handling hazards. It is best to avoid chemical contact or to limit contact. If chemicals must be handled, the following precautions are recommended:

1. Avoid direct skin contact.
2. Avoid inhalation of vapors.
3. Avoid dust or mists.
4. Avoid ingestion.

A training program with the following objectives should be established to reduce chemical misuse in handling:

1. An understanding of the physical characteristics of the chemical agents used and their possible reactivity with other substances.
2. An understanding of the chemicals' toxic properties and the effects of overexposure.
3. A knowledge of proper techniques and practices for handling, storing, mixing and disposing of hazardous chemicals.
4. A knowledge of good personal hygiene habits necessary to limit the effects of exposure.
5. An understanding of emergency procedures to follow in case of splash or spills.

Avoiding chemical hazards can be accomplished by posting a list of the potentially hazardous chemicals which includes instructions for properly handling the chemicals, storing the chemicals, using the chemicals and listing the antidotes for the chemicals.

Chemical agents normally found in industrial arts education areas are:

1. Adhesives
2. Ammonia
3. Body fillers
4. Carbon dioxide
5. Carbon Monoxide
6. Caustics
7. Chromium
8. Cutting fluids
9. Drain cleaners
10. Epoxy resins
11. Hydrogen sulfide
12. Lead fumes and dust
13. Metal fumes and dust
14. Paints, lacquers, stains
15. Refrigerants
16. Soaps and detergents
17. Solvents
18. Wood dust

Detailed information concerning these chemical agents can be obtained from the manufacturer or supplier. (When writing, ask for a "Material Safety Data Sheet.")

## Material Storage

Laboratories contain a variety of hardware items and supplies, each presenting a different storage problem. Storage methods may vary from instructor to instructor. Some instructors prefer an open-type storage (students permitted to use supplies as needed), while others prefer the closed-type storage (supplies are kept locked, accessible only to the instructor). Obviously, a combination of both systems may be used. Regardless of the system used, the storage facility should be properly located for convenience and safety. (Certain materials must be protected against such conditions as mildew, corrosion, rust, or warping.)

The National Safety Council (1969) recommends that the following safe materials storage practices be maintained:

1. The general supply storage room or area should have an outside door or be located as close as possible to the delivery door or unloading ramp for safety and convenience in unloading of long pieces of wood and metal or heavy objects.

2. The maximum floor loading specifications should be reviewed to insure adequate structural support for all storage areas.

3. Facilities in the general storage area should be reviewed to prevent material from obstructing access to fire alarm boxes, sprinkler system controls, fire extinguishers, first aid equipment, lighting and electrical switches and fuse boxes.

4. A minimum clearance of 18 inches should be maintained between the sprinkler heads and the storage of materials. Additional clearance should be provided if the material is highly flammable.

5. To reduce congestion, the inside passageway of the storage facility should be located close to the service area of the shop.

6. Metal or lumber may be stored either horizontally or vertically depending upon the space available, but horizontal storage methods are usually safer in storing long pieces of material. Large stacks of such material should be cross-tied to increase stability and reduce accidents caused by falling objects. When large piles of materials are continuously stored in the same location, a horizontal line should be painted on the adjacent wall to indicate the safe stacking height of that material.

7. Racks used for the storage of lumber or metal stock should be securely fastened to the wall and floor. When horizontal racks are used for storage, the shelves should incline toward the back to reduce the possibility of materials rolling off.

8. Bar stock and lumber should be stored in such a way that the ends do not protrude or project out into the storeroom or shop.

9. Materials should be stored or piled so that there is no danger of the material slipping or falling from the shelves.

10. Sheet metal should be stored so the edges do not extend over the edges of the table, cabinet, shelf or rack.

11. Clean rags and waste should be stored in metal containers or bins.

12. Acids and corrosive materials should be stored in special containers designed for the safe storage of such materials.

13. Oily and dirty rags should be stored in safety containers with self-closing lids, while other combustible materials should be stored in fireproof metal cabinets.

14. Matches of all kinds used in the shop should be kept in metal containers.

15. Small hardware items should be stored in small bins or drawers in a cabinet. All items should be neatly arranged and properly labeled for easy identification.

16. Sheets of metal, plywood, etc., should never be leaned or stored against the side of a wall.

17. Grinding wheels should be stored in clean dry areas which are not subject to extreme temperature changes. Special racks should be constructed and designed to fit the particular type and size of grinding wheel. The racks should be strong, plainly marked and located away from traffic areas. It is recommended that straight wheels, cup wheels, and disks of 6 inches or more in diameter be stored flat with corrugated paper between layers, while the tapered side wheels should be stored on the end. (p. 762)

Storage of Tools

The most common methods of tool storage are tool panels, centralized tool cribs, wall cabinets, bench drawers and moveable racks. The method used for storing tools will depend upon the design of the laboratory and the physical limitations of the students.

Ramp, Johnson, and McLuckie (1975) offer the following suggestions with respect to the safe storage of tools:

1. Tool storage facilities should be placed and arranged to minimize the distance students travel for tools. Tools used by all members of a class should be in a convenient and central location. Special and similar tools should be grouped and located near specific work areas.

2. Storage bins should not be overfilled. Space should be allotted to provide easy removal and replacement of tools in designated bins.

3. To avoid congestion, adequate aisle space and an open area surrounding the storage areas must be provided. At least six feet of floor space should be allowed around all tool panels and tool cabinets.

4. Tools should be stored or placed so that there is no danger of their becoming dislodged and falling from the panel. Tool holders, hangers, pegs or hooks should be attractive, sturdy, well-designed and constructed to hold the tool securely, yet permit the tool to be removed easily.

5. Sharp-pointed and cutting-edge tools should be mounted on the tool panel or in the cabinet so that they are below the eye level of shop workers.

6. Tool storage facilities should be attractive, well-planned and arranged to provide adequate space for all of the tools.

7. Special consideration should be given to the relative height and age of the students so that tools are not mounted beyond their reach.

8. Large, heavy and bulky tools should be stored near the bottom of the storage shelf or rack.

9. Long, heavy tools such as pry bars, handles, etc., should be stored horizontally to prevent falling.

10. All cutting-edge and pointed tools should be stored or mounted so as to protect the students from exposed sharp edges or points. Sheaths should be provided and used on all knives.

11. Sharp-edge and pointed tools should not be stored loose in drawers, tool kits, or boxes without adequate protection of the cutting edges.

12. Hand tools should be periodically inspected and properly maintained at all times. (pp. 129-130)

Storage of Chemicals

All chemical items kept in storage cabinets must be properly sealed and protected. Flammable liquids, such as gasoline, must be stored in properly labeled, approved, safety-type containers and housed in fireproof cabinets or rooms (Figure 12).

Figure 12.

Storage Cabinet
for Flammable Liquids

Flammable liquid storage cabinets must be marked "FLAMMABLE - KEEP FIRE AWAY," and must meet the National Fire Protection Association's test requirements (as contained in NFPA No. 30, Flammable and Combustible Liquids Code, Section 4-3.2):

> 4-3.2 Storage cabinets shall be designed and constructed to limit the internal temperature to not more than 325° F when subjected to a ten-minute fire test using the standard time temperature curve as set forth in Standard Methods of Fire Tests of Building Construction and Materials, NFPA No. 251. All joints and seams shall remain tight and the door shall remain securely closed during the fire test.
>
> 4-3.2.1 Metal cabinets constructed in the following manner shall be deemed to be in compliance with 4-3.2. The bottom, top, door, and sides of cabinet shall be at least No. 18 gage sheet iron and double-walled with 1½-inch air space. Joints shall be riveted, welded, or made tight by some equally effective means. The door shall be provided with a three-point lock, and the door sill shall be raised at least 2 inches above the bottom of the cabinet.
>
> 4-3.2.2 Wooden cabinets constructed in the following manner shall be deemed in compliance with 4-3.2. The bottom, sides, and top shall be constructed of an approved grade of plywood at least 1 inch in thickness, which shall not break down or delaminate under fire conditions. All joints shall be rabbetted and shall be fastened in two directions with flathead wood screws. When more than one door is used, there shall be a rabbetted overlap of not less than 1 inch. Hinges shall be mounted in such a manner as to not lose their holding capacity due to loosening or burning out of the screws when subjected to the fire test.

## Fire Safety

The nature of the industrial arts education laboratory work requires exposure to fire, heat and various combustible materials. Fire protection and prevention equipment should be provided in laboratories by the local school district. The following equipment and procedures are considered essential in a fire safety program:

1. Bulk storage for flammable materials in an area removed from the main school building.
2. Underwriters Laboratories listed oily waste containers for oily and paint-soaked rags.
3. Inspection and testing of fire extinguishers at regular intervals to make sure that they are fully charged and in proper working condition.
4. Instructions for students and teachers in the location and proper use of fire extinguishers and other fire fighting equipment.
5. Posting of fire alarm and evacuation procedures.
6. Locations of remote shutoff valve or switches for gas or oil-fired equipment, and procedures to de-energize electrical equipment in an emergency, should be known by students and teachers.

7. Approved fire blanket for each laboratory.

8. Fire extinguisher(s) of the proper type located in each laboratory and clearly labeled (Appendix E).

9. Fire resistant metal storage cabinets for paints, thinners, and other flammable materials.

10. Precaution taken against accumulation of saw dust in the air, around machinery and around workbenches by:
    a. using a fixed exhaust system.
    b. using a mobile vacuum unit for general cleanup.
    c. installing small vacuum units on dust-making equipment (sanders, grinders, grinding wheels, wire wheels, polishing buffs, etc.).

11. Handling gas cylinders of oxygen, acetylene, argon, carbon dioxide, etc., with extreme caution.

12. Use of check valves on welding blowpipes.

13. Oxygen cylinders in storage to be separated from fuel/gas cylinders a minimum distance of 20 feet or placed behind a noncombustible barrier at least five feet high having a fire resistance rating of at least one-half hour.

14. Cylinders without an attached safety cap are never to be handled.

15. Full or empty cylinders are to be marked or tagged.

16. Cylinders are to be stored in an upright position away from other combustible materials and away from heat sources.

## Electrical Safety

The laboratory instructor must realize that any electrical circuit is a potential hazard, regardless of the amount of voltage or current present. The hazard or resulting accident can generally be traced to defective equipment, unsafe work practices and a lack of knowledge of the dangers of electricity.

1. Defective equipment. Types of equipment frequently involved in electrical accidents include motor-driven equipment, control devices, portable electric tools, switches and panels.
    a. Improperly grounded equipment (ground wires missing, broken, or improperly connected).
    b. Open conduits, switch boxes, damaged or worn connections and exposed live wires.
    c. Insulation which is defective, inadequate, worn, frayed, wet, oily or deteriorated, creating short circuit possibilities and energizing equipment frames.
    d. Defective switches, receptacles, extension cords and lamp sockets.
    e. Dirty motor windings, improperly adjusted brushes and worn commutators.

f. Improperly connected power tools and defective insulation in portable tools.

g. Broken housings and loose or vibrating machine parts which might contact and energize tool or machine frames and expose live surfaces to operator.

2. Unsafe practices and work procedures can result in electrical accidents and fires. Some of the common unsafe acts committed in the industrial arts education laboratory which are to be avoided are:

a. Using ungrounded equipment and portable tools (except double insulated tools) or removing ground connections.

b. Using defective tools or equipment in need of repair.

c. Using equipment which does not meet the approval of the Underwriters Laboratories for the intended purpose.

d. Cleaning electrical panels, switch boxes, motors and other electrical equipment with water or dangerous solvents.

e. Overloading circuits or overfusing curcuits by using wrong size or type of fuse or circuit breaker.

f. Failure to use explosion-proof fixtures, switches, motors or other spark-proof items in hazardous locations.

g. Failing to positively lock out or otherwise de-energize and tag equipment or circuits to be worked on. (Relying on gloves, rubber mats, etc., for insulation while carrying out electrical installation or repair.)

h. Installing or extending electrical facilities in a manner not meeting the requirements of the National Electrical Code.

i. Closing switches or circuit breakers repetitively when there is a fault in the circuit.

j. Using light duty, ungrounded extension cords for industrial service.

k. Failing to maintain clear access to electrical panels (clearance of 30" is required by the federal code).

l. Using extension cords in place of permanent wiring installations.

m. Overloading motors, insulation, wires and/or electrical accessories.

n. Disconnecting electrical cords by pulling on the cords rather than on the plugs.

o. Using metal ladders while working on electrical equipment.

p. Failing to properly label switch panels and boxes.

3. Lack of knowledge. A number of electrical accidents happen in the industrial arts laboratory because students "just didn't know any better." Many students lack an understanding and respect of electricity. A situation which can be remedied through adequate supervision and implementation of a safety educational program concerning electricity.

Laboratory Maintenance

Studies by safety engineers have pointed out a definite relationship between the number of accidents in any particular laboratory and the housekeeping conditions of the laboratory. In the industrial arts education laboratory, the instructors have the direct responsibility, in addition to their other duties, for:

1. Establishing and maintaining cleanliness and orderliness.
2. Eliminating hazards.
3. Developing proper attitudes and orderly work habits of students.

Recommended housekeeping practices that are considered essential for the laboratory instructor to implement are:

1. Arranging all equipment to permit safe and efficient work practices.
2. Providing for materials and supplies to be safely stored.
3. Providing sufficient waste containers.
4. Having floors cleaned regularly.
5. Properly disposing of combustible waste materials.
6. Prohibiting the keeping of excess materials and debris on benches and in the work areas.
7. Conducting regular inspections to maintain clean and orderly conditions.
8. Cleaning splash guards and collecting pans of all machines that use oil and coolants.
9. Maintaining supply of brooms, bench brushes, shop towels and other cleaning equipment.
10. Using housekeeping tools, equipment and supplies properly.
11. Reminding students of their responsibility to keep the laboratory clean and orderly.
12. Organizing a housekeeping routine which involves all students.

In addition to the instructor's responsibilities in good laboratory housekeeping, the administrators and/or custodial services should:

1. Provide for the daily removal of all sawdust, shavings, metal cuttings and other waste materials.
2. Provide properly marked boxes or bins for various kinds of scrap stock.
3. Provide and regularly maintain adequate dust collecting systems.
4. Provide suitable containers for scraps, shavings, chips and other waste materials.
5. Provide adequate storage rooms, shelves, racks and cabinets for materials and supplies.
6. Provide brushes for the cleaning of equipment after each use.
7. Provide regular custodial service in addition to end-of-class cleanup.
8. Prohibit the use of compressed air to clean clothing, equipment and projects.
9. Maintain floor surfaces in a non-slip condition.
10. Develop and enforce procedures to reduce hazards.

## Hearing and Noise Exposure

It is difficult to teach in a noisy environment. Constant noise means shouting, irritation, and difficulty to concentrate. High intensity noise may also be hazardous to the students' and teachers' hearing if exposure is for long durations. Noise control, therefore, becomes an essential segment of a shop safety program.

Sound is a wave motion of energy traveling in the atmosphere. A vibrating body that causes air to pulsate generates sound. Sound may be either airborne or partially structure-borne. Structure-borne sound is usually caused when machine vibrations are transmitted by the floor to other parts of the classroom causing unwanted sound or noise. This structure-borne sound is called "impact sound." The final sound, in any case, is airborne noise which causes ear sensations.

The relative loudness (intensity) of sound is measured in decibels (dB). A decibel is a unit that is approximately equal to the smallest difference in intensity detectable by a normal ear. Actual noise measurements or audiometric readings can be made with a rather inexpensive and easy to use sound level meter.

Average speech has an intensity of about 60 decibels. The range of intensity extends from the threshold of audibility (0-20 dB) to deafening noise (approximately 150 dB) (Table 4).

TABLE 4

RANGE OF SOUND-LEVEL INTENSITY

| dB | Sound Source | Potential Hazards |
|---|---|---|
| 150 | Jet engine test cell | |
| 130 | Riveting steel tank | Pain and |
| | Pneumatic rock drill | possible |
| | Pneumatic press (close range) | damage |
| 125 | Pneumatic riveter | to ear |
| | Pneumatic chipper | |
| 120 | Threshold of Pain | |
| 112 | Turbine generator | |
| | Sandblasting | |
| | Punch press | |
| 110 | Drop hammer | Dangerous |
| | Drills, shovels, trucks operating | |
| 105 | Riveting machines, Pin routers | |
| | Wire braiders, Stranding machine | |
| | Circular saw | |
| 100 | Can manufacturing plant | |
| | Automatic screw machine | |
| | Ram turret lathes | |
| | Portable grinders | |
| 90 | Portable sanders | |
| | Engine lathes | Risky |
| | Pneumatic diesel compressor | |
| | Milling machine | |
| | Weaving mill | |
| | Welding equipment | |
| | Hearing Damage if Exposure Above this Level is Continued for an Extended Time | |
| 80 | Tabulating machines | |
| | Electric typewriters | |
| 75 | Stenographic room | |
| 70 | Electronics assembly plant | |
| 60 | Conversation | Safe |

Note: Taken from David Clark Co. sales publication, Form No. 17208P-19, Rev. 2-78.

The Occupational Safety and Health Administration (OSHA) of the Department of Labor has established permissable levels of noise exposure (Table 5) which set the amount of time that an employee may be exposed to various levels of sound as measured in decibels. If the regulations are not followed, physical damage can be done to one's ears. (Although OSHA regulations are not mandatory for public schools in New Jersey, the industrial arts education teacher should be familiar with the law in order to provide a safe environment for staff members and students.)

TABLE 5

PERMISSABLE NOISE EXPOSURES

| Duration per Day, Hours | Sound Level dB[a] |
|---|---|
| 8 | 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 1½ | 102 |
| 1 | 105 |
| ½ | 110 |
| ¼ or less | 115 |

[a] As measured on a scale of standard sound-level meter at slow response.

Note: Taken from OSHA general industry standards, Part 1910, Title 29, CFR, Section 1910.95, revised November 7, 1978.

The basic standard permits a person to work eight hours a day where the noise level does not exceed 90 dB. Where the sound levels exceed the standard, the law is explicit about what must be done. The corrective action program involves three basic steps:

1. Reducing noise at its source through administrative and engineering controls.

   a. Administrative Controls simply means reducing the amount of time that a person is subjected to excessive noise. This is accomplished by not allowing students or teachers to operate machines or to be in a high decibel noise environment for longer periods than the standard permits.

   b. Engineering Controls are more complex, and call for reducing noise levels through engineering design and equipment innovations. Some engineering control steps to consider are:

1. Noise will be minimized if shop laboratories are as large as practical, with ceiling heights of fourteen feet or more.

2. Curved ceiling designs should be avoided. The concavity tends to reflect noise and concentrate it at a point or points.

3. Only full-height partitions should be used as room dividers. Noise can travel over or under partial-height partitions.

4. Glossy surfaces and materials should be avoided because they have a tendency to reflect noise and not absorb it.

5. Exhaust systems generally are noise producers unless they are carefully designed, manufactured, installed and maintained.

6. Sound absorbing materials should be used for wall, ceiling and floor covering whenever possible.

7. Heavy, rigid, well-constructed and assembled and balanced machines should be ordered because they are inherently quieter in operation.

8. Only equipment that has an effective lubricating system should be used. Well-lubricated machines operate quieter.

9. Machines constructed of cast iron stands, bases and housings produce less noise than those constructed of sheet metal.

10. If possible, all electric motors should be mounted on flexible pads.

11. Machines that "freewheel" to a stop should be avoided wherever possible. They produce noise for longer periods. Brakes are suggested for radial arm saws, nonportable crosscut or ripsaws, band saws and disc or belt sanders.

12. Machines and equipment are to be in good repair and properly oiled with all worn or unbalanced parts replaced.

2. If administrative and engineering controls fail to reduce sound levels, personal protective equipment shall be provided and used to reduce sound levels. (Recommended equipment is noted in the section on Personal Protective Equipment.)

3. Carrying out a program of hearing conservation. OSHA regulations state that "in all cases where the sound levels exceed the values (shown in Table 5), a continuing, effective hearing conservation program shall be administered." This means that the protective program will go on as long as the noise levels exceed those permitted by law are not corrected by engineering controls.

## Personal Protective Equipment

While personal protective equipment might be considered as being secondary, or back-up, importance in a school safety education program (elimination of the hazardous areas, conditions, and attitudes being of primary importance), it's importance must not be underrated. It is the teacher's responsibility to see that proper personal protective equipment is used as a safety precaution. The significance attached to the use of personal protective devices can be noted in OSHA regulation 1910.132(a), in the OSHA General Industry Standards, Part 1910, Title 29, CFR, revised November 7, 1978.

> Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact.

## Protective Clothing

Dressing properly and safely for school can give students and teachers the basic protection needed against everyday safety hazards. "Dressing right for safety" is a slogan worth pursuing. It is recommended that the clothing guidelines be as follows:

1. Clothes should be comfortable but not loose.
2. Clothes should have provisions to fasten long sleeves at one-quarter arm length. Short sleeves are safer for working around machinery.
3. Clothes should be machine washable.
4. Clothes should be wear resistant.
5. Clothes should be heavy enough to provide protection from chips.
6. Neckties or scarves should never be worn around operating machinery.
7. Clothes that are torn or have loose pockets - or loose shirt tails - should not be worn around machinery. They have a tendency to get caught!
8. Cuffless pants or slacks should be worn. Cuffs can catch heels and molten metal chips.
9. Jewelry should not be worn while working in the shop laboratory.
10. Proper dress and care of clothing is the student's responsibility.

There are special areas where additional clothing must be worn to protect the student (Figure 13). There are also other items of outer clothing (laboratory coats, aprons, and coveralls) which should be considered for the protection of students and teachers.

| Hazardous Area | Specialized Clothing |
|---|---|
| Acid and Alkali | Butyl, Rubber, and Plastics |
| Electricity | Rubber |
| Flame | Asbestos, Aluminized Fabric |
| Flying Chips | Leather |
| Hot Metal | Asbestos, Leather, Aluminized Fabric |
| Oils and Solvents | Synthetic Rubber and Plastics |
| Severe Blows & Sharp Tools | Wire Mesh and Reinforced Leather |
| Strong Acids | Natural Rubber |
| Water | Rubber & other Waterproof Non-conductors |

Figure 13. Clothing for Special Areas

It is recommended that consideration be given to the use of:

1. Laboratory coats - to provide a safeguard against grease, dirt, hot materials and chemicals. If used while working around machinery, coats must either be short-sleeved or with buttoned long sleeves.

2. Aprons - to protect against sparks, hot metal splashes and liquids. Aprons must always be tied back.

3. Coveralls - to provide protection from grease, dirt, sparks, spillage and liquids. Coveralls are usually rugged and can withstand hard, long wear. They are especially recommended for automotive courses.

Protective Shoes/Leggings

Foot injuries in school laboratories are caused by the falling or dropping of heavy objects or getting the toes caught in toe-traps. Where the possibility of foot injuries exist due to the handling of materials, safety shoes with steel toe boxes should be required footwear. Students in electrical courses should never wear steel toe shoes.

In water or moisture-laden areas, rubber boots should be worn to prevent falls and to act as nonconductors of electricity.

Leggings (made of asbestos, leather, or flame-duck material) should be worn as protection in activities where sparks, acid spills, and metal splashing or splatter may occur. In particular, students and instructors pouring molten metal in the foundry areas must wear leggings of knee or hip length as protection against splashing.

## Protective Gloves

Finger injuries are the most frequently occurring laboratory accident. Therefore, the use of hand protective devices should be seriously considered. Proper gloves should be provided in areas where the probability of irritation or burns exist. These areas include: welding and all hot metals, sand blasting, plastics and any area where dangerous cleaning chemicals are used. A danger also exists in the handling of stock materials such as metals, rough lumber and plywood. Flameproof gauntlet gloves should be provided for welding and hot metal uses.

A special heat glove which provides greater mobility should be made available for handling items which are hot but not as extreme as molten or forged metal. These gloves are also applicable to hot plastics areas. Molten metal should only be handled in a crucible. Forged metals are to be handled with tongs.

Armored leather gloves should be made available to aid in the handling of stock materials. These protect the skin from cuts, slivers and other abrasions.

Butyl rubber gloves provide protection to hands from such agents as acids, peroxides, fuels, acetone, methyl ethyl ketone, liquid plastics, plasticizers, catalysts, alcohol, and oils.

## Hearing Protection

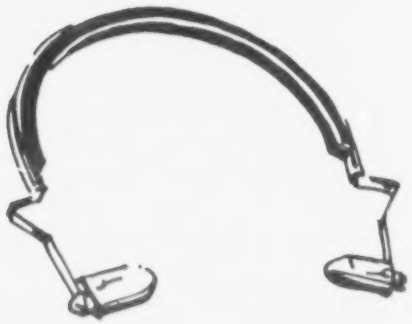
In noise-hazardous areas, there are three devices that provide ample hearing protection to the user. (The choice of device should be left to the wearer.) They are:

1. Muff Type (Figure 14). These protectors require no fitting by professionally trained personnel. Jaw movements will not break the ear seal thus rendering them ineffective. They provide the highest degree of noise reduction.

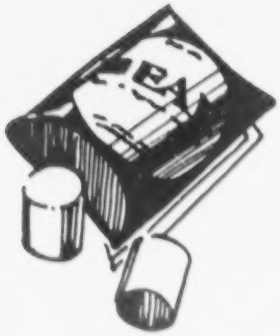
2. Soft cushion type (Figure 14). These protectors are air cushioned pads which provide a seal at the entrance to the ear canal. They are used by persons who prefer not to push plugs into the ear canals and who find the wider headband muff type too bulky.

3. Disposable plug type (Figure 14). These devices provide hygienic and effective protection. There may be, however, a few individuals who find it difficult to insert plugs into the ear because their ear canal is much smaller than normal.

Muff Type



Soft Cushion Type



Disposable Plug Type

Figure 14. Hearing Protective Devices

Eye Protection

The New Jersey Administrative Code, 6:3-1.14 states that:

> The Board of Education in every school district shall require each pupil and teacher in the public schools of the district to wear industrial quality eye protective devices while attending classes in vocational or industrial arts shops or laboratories in which caustic or explosive chemicals, hot liquids or solids, hot molten metals, or explosives are used or in which welding of any type, repair or servicing of vehicles, heat treatment or tempering of metals, or the milling, sawing, stamping, or cutting of solid materials, or any similar dangerous process is taught, exposure to which might have a tendency to cause damage to the eyes. Visitors to such classrooms or laboratories shall also be required to wear such protective devices.

To implement the intent and letter of the Code, a school district's eye protection program should take cognizance of the following recommendations:

1. The Board of Education, administrators, and instructors are responsible for establishing and maintaining an active safety program. Their responsibilities for the eye safety program are as follows:

   a. All school personnel shall assess the eye exposures for which they are responsible, and recommend the appropriate protection. These recommendations shall protect students, staff members and visitors.

   b. Industrial arts instructors shall see that eye protective devices are worn at all times in those areas that have been identified as hazardous areas.

   c. Eye protective devices shall be supplied and maintained by the school district and loaned without cost to students, staff members and visitors.

   d, The eye safety program shall be physically inspected and reviewed periodically to maintain the effectiveness of the program.

   e. The program shall be rigidly enforced and monitored by all concerned. There should be no deviation from the program once it is accepted and put into use.

2. Students who require corrective lenses shall be encouraged to obtain prescription industrial-quality safety glasses. With prescription glasses that are not industrial-quality safety glasses, the student should be required to also wear an appropriate cover goggle. Contact lenses present specific hazards in the laboratory setting and their use should be discouraged.

   Note: Standard impact-resistant lenses are not the equivalent of industrial-quality protective lenses.

3. Storage and sanitation facilities shall be provided within the shop or classroom for all eye protective devices. School districts have found that they have better eye protection programs when individual glasses are provided for each student enrolled in the industrial arts classes.

   Good eye protective devices require clean and defect free lenses. Therefore, lenses shall be cleaned daily. Pitted or scratched lenses shatter easily, impairing the wearer's vision, and should be replaced.

   If a protective device is to be worn by more than one student, it will require a means of disinfection. An effective method for cleaning and disinfecting eye protective equipment is:

   a. Thoroughly clean with soap and warm water periodically.

   b. Carefully dry with nonabrasive tissue.

   c. Store in ultraviolet sanitation cabinet.

4. School officials who are charged with the responsibility of purchasing the eye protective devices should keep in mind the hazardous exposures and purchase devices appropriate for the type of exposure (Table 6). (A more detailed selection chart for eye protectors can be found in Appendix H.)

   Protective devices must be used to fit the designated activities, and must meet or exceed standards promulgated by the American National Standards Institute (ANSI Z87.1-1979).

TABLE 6

SUGGESTED EYE PROTECTIVE DEVICES

| Hazard[a] | Protector |
|---|---|
| Caustic or Explosive Chemicals | Clear Goggles, Splash Proof |
| Explosives (Solids or Gases) | Clear Goggles |
| Dust Producing Operations | Clear Goggles, Splash Proof |
| Electric-Arc Welding | Welding Helmet |
| Oxy-Acetylene Welding | Colored Goggles or Welding Helmet |
| Hot Liquids and Gases | Clear Goggles, Splash Proof |
| Hot Solids | Clear or Colored Goggles or Spectacles |
| Hot Molten Metals | Clear or Colored Goggles |
| Heat Treating or Tempering of Metals | Colored or Clear Spectacles or Goggles |
| Glare Operations | Colored Spectacles or Goggles or Welding Helmet |
| Shaping of Solid Materials: Chipping, Cutting, Grinding, Milling, Sawing, Stamping | Clear Goggles or Spectacles |
| Repairing or Servicing Vehicles | Clear Goggles or Spectacles |

[a] Any other similar activity being conducted in the instructional program, where exposure might have a tendency to cause damage to the eyes, requires the use of proper eye protective devices.

Note: Taken from N.J.A.C. 6:3-1.14 (Appendix G).

5. Potential impact hazards. Possibly the greatest danger to the eyes is accidental collision with flying objects. Chips from the chipper hammer or the metal working tool, the waste particles from grinding or woodworking, a broken tool or grinding wheel, or an improperly driven nail are all eye exposure hazards that must be protected against. Plastic frame safety glasses with side shields afford maximum eye protection against impact damage.

6. Potential chemical splash hazards. Protection is needed that absolutely seals the eye against any possible entry of chemical splashes. For these conditions, flexible vinyl jumbo plate goggles with splash-proof indirect ventilators should be worn.

7. Potential dust hazards. Where extreme dust hazards exist, plastic frame flexible goggles are recommended. Safety glasses with side shields may also be used.

8. Potential light ray and glare hazards. The light rays cast from welding and cutting operations can be highly injurious to unprotected eyes. Heat treating, metal pouring, steel and glass furnaces and laser beams are other sources.

   a. In gas welding, cup-type welding goggles with green filter lenses are most commonly used.

   b. For electric welding, helmets are necessary to protect the head and eyes from infrared and ultraviolet radiation burns, hot metals, chips, and flying sparks.

   c. Photochromic and phototropic (photosun-photogray) lenses may not be worn as protective eyewear where hazardous infrared or ultraviolet radiation is present.

9. The protective devices must be used to fit the designated activities and must meet or exceed standards promulgated by the American National Standards Institute (ANSI Z87.1-1979) and/or the prescribed government specifications for such devices.

   a. All eye protective devices must be examined regularly to see that each is functional.

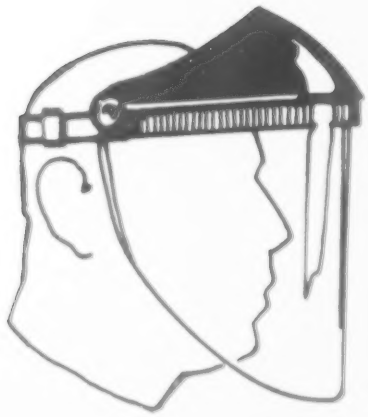
   b. Materials used in eye protectors must be nonirritating to the skin.

   c. All spectacles or goggles must have industrial-quality impact-resistant lenses. Wherever possible, lenses should have a six-base curve, not flat lenses. All spectacles must have side shields.

Face Protection

Face shields should be used to protect students and teachers from flying objects during certain operations. Three types of face shields (Figure 15) available for students and teachers to use are: 1. shield without crown or chin protectors; 2. shield with crown protector; and 3. shield with crown and chin protectors.

Shield without
crown or chin protectors



Shield with
crown protector

Shield with crown
and chin protectors

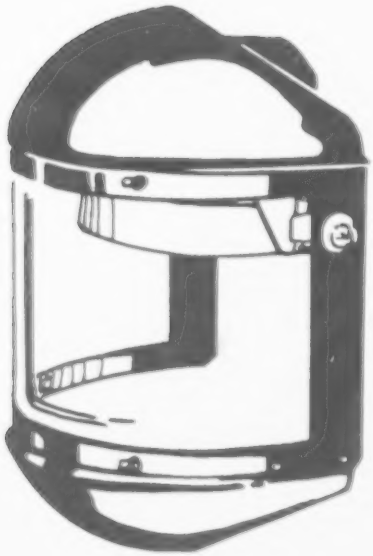


Figure 15. Face Shields

In addition to safety glasses or goggles, face shields should be worn:

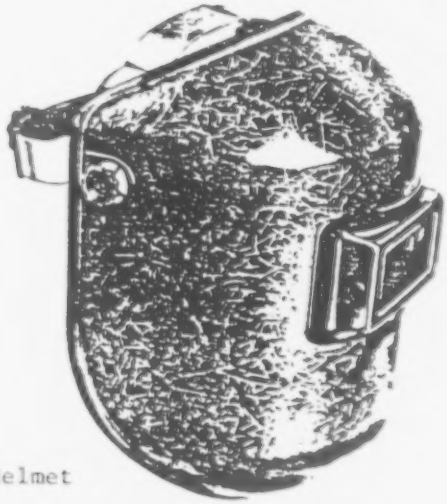
1. when handling chemicals and operators are subject to severe exposure to acid burns, chemical fumes or splashes;

2. when handling molten metals; and

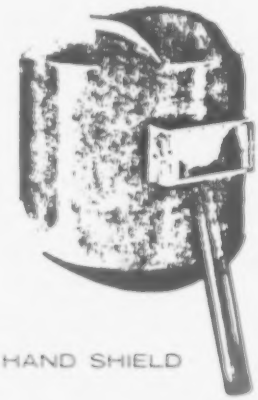
3. when operating machines that can produce flying objects, such as when grinding or working on a lathe.

To protect the eyes, ears, face and neck against splatter and intense radiant energy produced by welding, welding shields or helmets (Figure 16) should be used. Welding helmets are to be constructed from opaque vulcanized fiber, reinforced plastic, or similar material which is not readily flammable, and is an insultator from heat and electricity. Clear cover plates are used to protect the filter lenses from splatter damage. Filter lenses are marked with shade numbers for easy identification.

Students, while welding, should never use the handshield. The handshield may be used by the instructor while checking students who are welding.



Helmet



HAND SHIELD

Figure 16. Arc Welding Shields

## Head Protection

In the industrial arts education laboratory, head injuries due to falling objects or bumping are usually nonexistent. Head protection must be available for a class in a building construction program or in a program using a boom to raise and lower objects. Generally, head protection should be provided whenever there is danger of falling objects or materials.

Hard hats (Figure 17), used in a building construction program, are usually made of light-weight materials such as aluminum, plastic, or fiberglass. For health reasons, hard hats should have replaceable sweatbands, be noncombustible, water resistant, solvent resistant and, if worn near electrical equipment, nonconductors.

All hard hats must also be of industrial quality, and meet the requirements and specifications of the American National Standards Institute, Safety Requirements for Industrial Head Protection, (ANSI 789.1-1981).

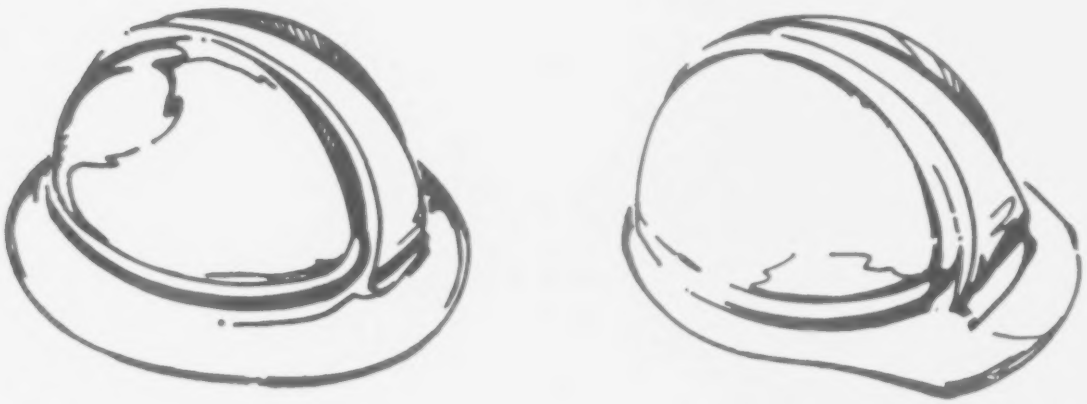


Figure 17. Hard Hats

Another potential head hazard is long hair. Long hair can be caught in rotating equipment such as drills, lathes, and other power tools. Long hair must be tied back, or covered with a cap or hair net.

In welding areas or other areas where sparks or flames are present, fire resistant coverings should be provided for the long hair. These coverings should be without visors. During welding, these coverings must be worn under the welding helmets.

## Respiratory Protection

There are hazardous areas where students may be required to wear personal respiratory devices (Table 7). The air purifying devices consist of a mask which covers the nose and mouth to provide protection by removing the contaminant from the air, using a filter/cartridge, before it is inhaled (Figure 18).

TABLE 7

GUIDE FOR SELECTION OF RESPIRATORS

| Hazard | Respirator |
|---|---|
| Oxygen Deficiency | Self-contained breathing apparatus.<br>Hose mask with blower.<br>Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm. |
| Gas and Vapor Contaminants Immediately dangerous to life or health. | Self-contained breathing apparatus.<br>Hose mask with blower.<br>Air-purifying, full facepiece respirator with chemical canister (gas mask).<br>Self-rescue mouthpiece respirator (for escape only).<br>Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm. |
| Not immediately dangerous to life or health. | Air-line respirator.<br>Hose mask without blower.<br>Air-purifying, half-mask or mouthpiece respirator with chemical cartridge. |
| Particulate Contaminants Immediately dangerous to life or health. | Self-contained breathing apparatus.<br>Hose mask without blower.<br>Air-purifying, full facepiece respirator with appropriate filter.<br>Self-rescue mouthpiece respirator (for escape only).<br>Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm. |
| Not immediately dangerous to life or health. | Air-purifying, half-mask or mouthpiece respirator with filter pad or cartridge.<br>Air-line respirator.<br>Air-line abrasive-blasting respirator.<br>Hose mask without blower. |
| Combination gas, vapor, and particulate contaminants Immediately dangerous to life or health. | Self-contained breathing apparatus.<br>Hose mask with blower.<br>Air-purifying, full facepiece respirator with chemical canister or appropriate filter (gas mask with filter).<br>Self-rescue mouthpiece respirator (for escape only).<br>Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm. |
| Not immediately dangerous to life or health. | Air-line respirator.<br>Hose mask without blower.<br>Air-purifying, half-mask or mouthpiece respirator with chemical cartridge and appropriate filter. |

Note: "Immediately dangerous to life and health" is defined as a condition that either poses an immediate threat to life and health or an immediate threat to severe exposure to contaminants, such as radioactive materials, which are likely to have adverse effects on health.

From American National Standards Institute, Practices for Respiratory Protection, (ANSI Z88.2-1969).

Respirators are manufactured for the following respiratory hazards commonly found in industrial arts education laboratories:

1. Nuisance dusts (nontoxic irritants such as wood, cement, etc.)
2. Toxic dusts (lead, selenium, etc.)
3. Mists (spray painting and finishing, electroplating, etc.)
4. Heated metal or chemical fumes (zinc, exhaust, etc.)

In each case, engineering controls, such as hoods and dust/spray collecting systems, should be considered first in the elimination of respiratory hazards. Personal devices should only be the secondary precautionary method to be used.

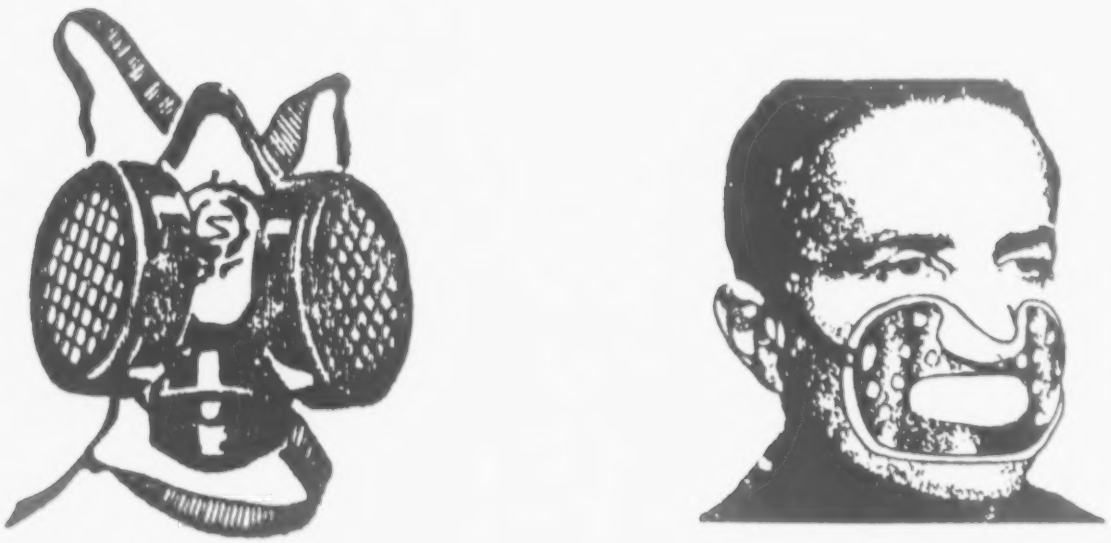


Figure 18. Respirators

# SAFETY INSTRUCTION TECHNIQUES

## General Safety Rules

Very important elements in any laboratory safety education program are the performance safety rules that accompany the instruction on proper tool and machine usage. Instructors should not expect students to use machines, work with tools, fabricate materials or conduct themselves in a safe manner in the laboratory unless detailed instruction is given. Instruction must include safety rules.

It is recommended that the following rules be adopted for all industrial arts education laboratories:

1. Safety glasses, with side shields, or goggles shall be worn in all laboratory classes. Additional eye and/or face protection must be worn when working around certain specified machinery or performing special operations.

2. Contact lenses should not be worn when working in the laboratory area.

3. No smoking is allowed in any of the laboratories, classrooms or adjoining hallways.

4. No food or beverage is allowed in any laboratory or classroom.

5. Long hair is to be tied back or netted when wearer is working in the laboratory.

6. Rings or other jewelry must be romoved before working in all laboratories.

7. Any loose clothing is to be removed or fastened. Loose sleeves are to be rolled above the elbows.

8. Sandals or open-toe shoes are not to be worn in the laboratories.

9. No tool or machine is to be used until student has received instructions and has learned its safe and proper use.

10. All sharp-pointed objects are to be carried with the point down. Materials with sharp and jagged edges are to be handled with care.

11. Help is to be sought for handling heavy or awkward materials. Lift with the leg muscles, not the back.

12. Wipe up any liquids spilled on the floor or tables immediately.

13. Oily rags and other combustible materials should be placed in approved metal containers.

14. Tools or machines are not to be used in the laboratory if the instructor is not present.

15. All broken tools, machines or other unsafe conditions must be reported to the instructor immediately.

16. Anyone operating a machine is not to be disturbed.

17. All injuries, however slight, are to be reported to the instructor immediately.

18. Floor and work surfaces are to be kept clear of scraps and litter.

19. Machines that have been tagged "defective" are not to be operated.

20. All drawers, cabinet doors, vises, etc., should be closed when not in use.

21. No one shall engage in horseplay or create a disturbance in the laboratory area.

22. It is essential that all students know:

    a. the location of all emergency switches,

    b. the fire drill procedures, and

    c. the first aid procedures in the event of an accident.

Hand Tool Care and Use

Hand tool misuse or abuse results in nearly 20% of all industrial arts education injuries in a school year. Proper instruction should be given by the laboratory instructor in the care and use of all hand tools.

1. Tools should be stored in cabinets or in a tool rack when not in use.

2. Keep edged tools, such as chisels, with edges covered flat in a drawer or tray rather than in wall racks.

3. Tools should be kept in good condition. (Dull or damaged tools contribute to many accidents and injuries.)

4. Suitable handles (plastic or wood) should be attached securely enough to the head of each tool that requires a handle to keep it from flying off.

5. Blades of cutting tools must be dept sharp and properly angled.

6. Mushroomed heads of chisels, punches or similar tools should be restored and made safe by dressing with a grinding wheel or file.

7. Tools should be rubbed briskly with a cloth partially saturated with fine oil to minimize rusting. (If tools have rust spots, they can be rubbed with a course cloth containing penetrating oil. For heavier rust, abrasives or steel wool can be used.)

8. Periodic inspection of all hand tools (by the laboratory instructor) is a safety must-do. (Many tools can be easily repaired by using the manufacturer's parts, repair kits and instructions.)

General Hand Tool Safety Rules

It is imperative that students adhere to the following recommendations:

1. Adequate eye protective devices must be worn at all times.

2. The correct tool should be selected for the job.

3. Hands should be kept free of oil and grease.

4. Sharp-edged and pointed tools should be handled with care. (Carry tools in such a way to protect yourself and others.)

5. Small or short objects should be held securely in a vise or clamp.

6. Tools are never to be carried in the pockets.

7. Tools with loose or cracked handles are not to be used.

8. Clean the tool and return it to the proper storage area when finished using it.

9. Tools are only to be used for the purpose for which they were intended.

10. Any breakage or malfunctions are to be reported to the instructor immediately.

Specific Safety Rules for the Proper Care and Use of Hand Tools

The Hand Tool Institute (1977) recommends that the following rules be adopted:

1. Chisels

   a. Always wear safety goggles to protect your eyes.

   b. Never use cold chisels for cutting or splitting stone or concrete.

   c. Never use a dull chisel or one with a mushroomed head.

   d. Discard any chisel if it is bent or shows dents, cracks, chips or excessive wear.

   e. Replace damaged handles with an equivalent new handle.

f. Handles on wood chisels should be strong and substantial.

g. Mallets should be used only with socket firmer chisels.

2. Clamps

a. Store C-clamps by clamping them in a rack.

b. Discard any clamp that has a bent frame or a bent spindle.

c. Do not use a wrench, pipe, hammer, or pliers to gain extra tightening.

d. Never use a C-clamp for hoisting work.

e. Avoid using extra large clamps just for the sake of their throats. Use deep-throat clamps instead.

3. Hammers

a. A hammer blow should always be struck squarely with the hammer striking face parallel with the surface being struck.

b. When striking another tool (chisel, punch, wedge, etc.), the striking face of the hammer should have a diameter approximately 3/8" larger than the struck face of the tool.

c. Always use a hammer of suitable size and weight for the job.

d. Never use one hammer to strike another hammer.

e. Never use a hammer with a loose or damaged handle.

f. Discard any hammer if tool shows dents, cracks, chips, mushrooming or excessive wear.

g. Never redress hammers.

h. Never strike with the side or cheek of a hammer.

4. Pliers

a. Pliers should not be used for cutting hardened wire unless specifically manufactured for this service.

b. Never expose pliers to excessive heat.

c. Always cut at right angles. Never rock from side to side or bend the wire back and forth against the cutting blades.

d. Do not bend stiff wire with light pliers.

e. Never use pliers as a hammer, nor hammer on the handles.

f. Never extend the length of handles to secure greater leverage.

g. Pliers should not be used on nuts or bolts.

h. Oil pliers occasionally.

5. Ripping or Punch Pars

a. Be sure of footing, fulcrum and grip.

b. Crowbars should be kept in good condition; a dull, worn point on a crowbar is more apt to cause trouble than a sharp point.

c. Crowbars should be stored in racks.

6. Saws

a. Saws should be kept sharp.

b. Whenever possible, use a sawhorse or bench to support the work.

c. Use a vise to secure work when using a hack saw.

d. Saws should be kept oiled to prevent rusting.

e. Hang saws by the handles through holes in the tip of the blade or otherwise stored to protect the teeth.

7. Screwdrivers

a. Make sure that the tip fits the slot of the screw; not too loose and not too tight.

b. Do not use a screwdriver for prying, punching, chiseling, scoring or scraping.

c. Do not use a screwdriver near live wires.

d. Do not expose a screwdriver to excessive heat.

e. Redress a worn tip with a file to regain a good straight edge.

f. Discard a screwdriver that has a worn or broken handle.

g. Use a screw-holding screwdriver to get screws started in awkward, hard-to-reach areas.

h. Do not use pliers on the handle of a screwdriver to get extra turning power.

i. Screwdrivers are best stored in a rack.

j. Keep screwdriver handles free of grease.

8. Snips

a. Wear safety goggles and gloves when using snips.

b. Never cut sheet metal that is thicker than 0.062 inches.

c. Use snips for cutting soft metal only.

d. Use the right size and type of snips for the job at hand.

e. Use only hand pressure for cutting.

f. Snips should be stored in a rack.

g. Oil the pivot bolt on the snips.

h. Keep the nut on the bolt properly adjusted at all times.

i. Sharpen the edge of snips by grinding or filing from outside toward the inside edge. Never sharpen the inside ground surface of a snip.

j. Do not use snips as a hammer, screwdriver or pry bar.

k. If the snips have locking clips, they should be used.

9. Vises

a. Use bolts in all the holes in the base of the vise.

b. Use lock washers under the nuts.

c. Do not use the jaws of the vise as an anvil.

d. When work is held in the vise for sawing, saw as close to the jaws as possible to prevent vibration.

e. Avoid clamping work with heavy pressure at the corner of the vise jaws.

f. Never use an extension handle for extra clamping pressure.

g. Discard any vise that exhibits the slightest hairline fracture.

h. Never pound on the handle to tighten beyond hand pressure.

i. Never try to repair a vise by welding or brazing.

j. Adjust the vise for play between nut and screw or replace them when excessive play develops in the handle.

10. Wrenches

a. Never use a pipe extension or other form of "cheater" to increase the leverage of any wrench.

b. Only use a wrench whose nut opening exactly fits the nut. Care should be exercised in selecting inch wrenches for inch fasteners and metric for metric fasteners.

c. Always pull on a wrench handle and adjust your stance to prevent a fall if something lets go.

d. Use a straight, rather than an offset-handled wrench when conditions permit.

e. To free a "frozen" nut or bolt, use a striking-face box wrench or a heavy-duty box or socket wrench. Application of penetrating oil beforehand is recommended.

f. Never cock an open-end wrench. Be sure the nut or bolt head is fully seated in the jaw opening.

g. Adjustable wrenches should be tightly adjusted to the nut and pulled so that force is on the side of the fixed jaw.

h. Avoid over-torquing.

i. Never expose any wrench to excessive heat which may draw temper and ruin the tool.

j. Wrenches should not be ground to change their shape.

k. Warning: Ordinary plastic-dipped handles are designed for comfort - not for electrical insulation.

General Power Equipment Safety Rules

Before allowing students to operate any power tool or machine, safety instruction must be given. Demonstrations and directions by the instructor should exemplify the correct way to use power machinery. Instruction should also include the following safety rules that apply to the use of machinery:

1. Obtain instructor's approval before operating any power equipment.

2. Always wear proper eye protective devices.

3. Remove jewelry, eliminate loose clothing and confine long hair.

4. Never operate a machine if over-tired or ill.

5. Operations should be thought through before being performed.

6. Make all the necessary adjustments before turning on the power.

7. Make sure all guards are in place and functioning properly.

8. Allow the machine to reach its full operating speed before starting to feed the work.

9. Only approved push sticks, push blocks and feather-boards should be used.

10. Keep machine tables and working surfaces clear of tools, stock and other project materials.

11. Feed the stock carefully and only as fast as the machine will cut it easily.

12. Hands should be kept a minimum distance of 4" from the cutting tool.

13. If a machine is not working properly, the instructor should be informed immediately.

14. The operator should not allow his/her attention to be distracted while using a machine.

15. Avoid "walking through" or "crowding around" areas where machines are being operated by other students.

16. Machines should never be left running while unattended.

17. Machines should not be used for trivial operations.

18. A small brush should be used to clean machines after operations are completed.

19. When oiling or adjusting a machine, be sure the power switch is "off."

20. If an object is too heavy or awkward, get help.

21. Oily rags used to wipe down machines should be placed in a metal container.

Specific Laboratory Safety Rules

In addition to safety rules that are relevant to all shop areas, there are rules that instructors may wish to establish for their specific areas. Examples of such rules are as follows.

Automotive/Power Technology Safety Rules

Safety is one aspect of automotive/power technology that cannot be over-emphasized. Electrical voltages, flammable liquids and gases, high pressure fluids and controlled burning of fuels are some of the dangerous situations in the laboratory. (The instructor should present the following safety rules at the start of the school year and again periodically throughout the school year.)

1. General conduct.

   a. Remove all jewelry before starting work.

b. Do not engage in horseplay.

c. Follow the instructor's directions carefully, especially when working with electricity.

d. Always use the proper tool for the job.

e. Wear proper eye protective devices.

f. Safety clothing should be worn when welding, changing batteries or working with chemicals.

g. Do not carry tools in your pockets.

h. Objects should not be thrown around the laboratory.

i. Do not work in the shop if you feel ill or tired.

2. Tools and equipment.

a. Inspect all wires and circuits for defects. Report all defects to the instructor immediately.

b. Never remove any guard from a machine.

c. Operate engines only when there is sufficient ventilation or exhaust tube is connected and fan is on.

d. Do not start a piece of equipment just to see what will happen.

e. Never make adjustments, lubricate or clean a machine while it is running.

f. Do not distract the attention of a machine operator.

g. Make sure any electrical component is discharged before touching.

h. Always consider an electrical circuit as "live" until you personally confirm that it is not.

i. When starting a device, be sure the immediate area is clear of all tools, equipment, and unauthorized personnel.

j. Start cars only in neutral and with the emergency brake on.

k. Keep chain hoist hook above head height.

3. Personal health considerations.

a. Wear an approved respirator while spray painting or abrading materials such as fiberglass and other toxic substances.

b. Do not clean hands in solvent or gasoline. These materials are explosive and may irritate the skin.

c. Lift heavy objects properly to avoid back strain. Obtain help if the object is excessively heavy or awkward to lift.

d. Never place any part of your body in front of a high pressure grease gun or a high pressure air hose.

e. Never aim an air hose at another person.

f. Never use compressed air to blow dirt away from the skin or clothing.

g. Do not jack up a vehicle if anyone is under or in it. Once the vehicle is jacked up, secure with permanent jack stands and do not shake the vehicle or climb on it while it is elevated.

h. Make sure long jacks handles are barricaded or raised out of the way to avoid someone tripping over them.

i. Use a bumper jack only for its intended purpose of emergency tire replacement.

j. Do not run a vehicle when it is on a hoist. Use caution when lowering a vehicle.

4. Flammable and combustible liquids.

a. Be sure the exhaust fan or vents are operating in the flammable liquids storeroom.

b. Draw out only as much as you need for your class period or particular operation.

c. Dump waste or excess materials only in covered metal containers, as directed by the instructor.

d. Use a funnel when pouring into a small container.

e. Clean up spills and drips immediately. Dispose of the rags and waste materials as instructed.

f. Read and follow instructions for handling and mixing catalysts with resins or finishes.

g. Never pour catalysts back into the original container.

h. Always add catalyst to resin, not resin to catalyst.

i. Never apply resin, paint or other finishing material near areas used for cutting, welding, grinding or other hot work.

j. Be sure that the working area is well-ventilated.

k. Store thinners and solvents only in original purchase containers or approved safety cans.

l. Use rubber gloves to minimize chances of skin irritation when working with epoxy and/or polyester resins.

m. Wash hands and other exposed skin areas before leaving the laboratory.

5. Greases, oils, fuels and solvents.

a. Clean up all spills immediately and ventilate the area.

b. Use only approved solvents for cleaning parts. Do not use gasoline.

c. Be sure that there is proper ventilation before an engine is started.

d. Keep oil-soaked rags in approved oily waste containers.

e. Check fuel connections for leaks before starting an engine.

f. Keep flammable liquids in approved containers.

6. Storage batteries.

a. Batteries should be stored or charged only in well-ventilated areas. Do not breathe fumes or battery acid.

b. All sources of ignition should be remote from the battery storage area. (No smoking, no lighted matches, no sparking from tools, etc.)

c. Do not work on batteries while on discharge or charge.

d. Proper protective clothing should be worn when handling batteries. (Rubber gloves, goggles with face shield and apron.)

e. Metal jewelry, such as rings, bracelets, or necklaces, should not be worn around batteries.

f. Acid spills can be neutralized with weak ammonia solution or a bicarbonate of soda solution, or diluted by large quantities of water applied immediately.

g. Battery chargers should be connected or disconnected only when charger is "off."

h. When "jump starting" a battery, make the second connection of the jumper cable on the frame of the vehicle, not on the battery terminal.

i. Deluge showers and eye wash fountains should be provided adjacent to the battery charging area.

Drafting Safety Rules

Although many students are familiar with the basic equipment used in the drafting room, safety instruction must be given in the proper care and use of the materials and equipment. Some of the rules that should be considered are:

1. General conduct.

   a. Immediately pick up small items, such as pencils, thumb tacks or drafting tape, that fall on the floor.

   b. Do not engage in horseplay.

   c. When moving about the room, care should be taken not to bump into drafting machines or other students.

   d. Keep all storage and tool drawers closed when not in use. Remove what is needed and close the drawer.

   e. Return all tools to their proper place.

   f. Care should be exercised when using cleaning fluid to clean table tops.

2. Tools and equipment.

   a. Sharp tools should be positioned out of the way when not in use.

   b. Pencils and other sharp objects should never be thrown from one student to another.

   c. Thumb tacks, pencils, compass points and leads must be kept out of the mouth.

   d. Sharpen lead pencils only on one end.

   e. Use compass, dividers and other equipment only for their intended purpose.

   f. Do not permit ink to enter any open cuts or scratches.

   g. When using Exacto knives for tracing repair or model building:
      1. Only use a knife with a sharp blade.
      2. Apply only enough pressure to make the cut.
      3. Never strike a metal surface with the blade.
      4. Sharpen the blade when it begins to dull.
      5. Make cuts away from the hands or body.
      6. Do not carry blade exposed. Carry blades in the case provided for that purpose.

   h. Use paper cutter only after receiving proper instruction in its operation.
      1. No more than 10 sheets should be cut at one time.

2. Do not exceed cutting board size with paper.
3. Only one person is to operate cutter at a given time.
4. Do not disconnect or bypass guard.
5. Lock paper cutter immediately after using it.

i. When operating printmaker:
1. Operate only with instructor's supervision.
2. Make no adjustments, other than speed, while machine is running.
3. Do not put hands near face or eyes after handling finished prints.
4. When completed, wash hands thoroughly.

j. All tools must be returned to their proper storage places after using them.

3. Furniture.

a. When sitting on a chair or stool, keep all four legs of the chair or stool on the ground.

b. Do not make stool height adjustments while sitting on the stool.

c. Chairs with rollers should not be used as scooters.

d. Drafting table tops should be raised and lowered carefully to avoid pinching fingers.

e. All storage cabinet doors and drawers and drafting table drawers must be kept closed except when removing or returning items.

## Electricity/Electronics Safety Rules

The potential danger of serious physical harm in the electricity/electronics laboratory should be instilled in the minds of the students. Safety presentations must be a daily occurrence when working with electrical equipment and electronic circuitry.

1. Electricity.

a. Rubber gloves should be worn when handling any kind of corrosive acid.

b. Cut away from the body when removing wire insulation.

c. Never attempt to repair electrical appliances which are hot.

d. The electrical code should be followed thoroughly when installing wire.

e. All electrical wire must be considered live until proven otherwise (by a safe method).

f. Use only properly insulated tools.

g. Make sure the correct procedures are followed when doing a job.

h. Always protect the eyes when looking at an electric arc.

i. Make sure all electrical circuits are off before working on them.

j. Electrical cords should only be removed by grasping the plug bodies.

2. Electronic devices.

a. Keep chassis of an AC-DC radio clear of ground wires and other grounded conductors.

b. Be sure capacitor is discharged before touching its terminals or connections.

c. Disconnect electric cord from power before touching anything behind transmitter panel.

d. Remove headphones while working on a transmitter or receiver.

e. Make certain chassis, cabinet, and cable shield of a transmitter or receiver are grounded.

f. Wear gloves, spectacles or goggles and a face shield when handling a cathode-ray tube.

3. Soldering.

a. Wear adequate eye protection.

b. Work in a well-ventilated area.

c. Do not inhale fumes from the soldering process.

d. Clean up spilled flux immediately.

e. Wash hands immediately after soldering.

f. Care should be taken not to cut or burn the electrical cords on electric soldering guns or irons.

g. Do not leave hot soldering gun or iron where others may accidently come in contact with it.

h. Electrical splices should not be soldered with acid-core solder.

General Shop Safety Rules

The variety of student activities conducted in a general shop necessitates broad-base safety instruction. Some of the safety rules recommended for consideration are:

1. General conduct.

   a. Report all injuries, no matter how slight, to the instructor immediately.

   b. Horseplay, such as playing and running, is never permitted.

   c. Keep talking to a minimum and pay attention to the job at hand.

   d. Do not throw anything in the shop at any time.

   e. Keep the floor free of pop rivets, screws, sand, wood and metal scraps to avoid slipping or tripping.

   f. Any liquid spilled on the floor should be cleaned up immediately.

   g. Keep locker doors closed at all times except when actually getting something out or putting it away.

   h. Flammable objects, such as oily or paint-soaked rags, are to be kept in a covered metal can.

   i. Be safe, don't be sorry. Seek teacher's assistance if uncertain of proper procedure to follow.

   j. At the end of the period, all used machines should be cleaned, the floor swept, tools and stools put away. A clean shop is a safe shop.

2. Personal safety.

   a. Wear proper eye protective devices at all times.

   b. Never carry tools in pockets.

   c. When carrying cutting tools, keep the sharp edges down.

   d. Use a tool only for the purpose for which it was designed.

   e. Do not allow tools to protrude over the edge of the workbench.

   f. Do not wear loose clothing, jewelry, ID bracelets, rings, watches, or tags when working in the shop.

   g. Long hair must be secured with a hairnet or cap when operating machines.

   h. Never operate a machine without all the guards and protective devices in place.

i. Never stand near the foundry area when other students are pouring hot metal into a mold.

j. Stay outside of the operator zone when another person is operating a power machine and refrain from talking to the student.

k. Never use files with loose handles or without handles.

l. Always wear properly shaded goggles or helmet when brazing or welding.

m. Do not attempt to lift heavy objects alone or unnecessarily.

n. Report all witnessed unsafe practices to the offending student and to the instructor at once.

3. Tools and equipment.

a. Students are not to operate any machine until instructed in its proper use, and have passed both the written and performance tests.

b. Power tools are not to be used without permission of the instructor.

c. Inform the instructor immediately of any tool or machine that is out of order.

d. Always keep vises closed when not in use and the vise handles in a vertical position.

e. Never leave a machine running when not in use or when unattended.

f. No more than one person, generally, is to operate at a work-station.

Graphic Arts Safety Rules

Graphic arts injuries commonly occur from improper lifting practices, chemical and heat burns and tripping or falling. Student injury in the laboratory can be reduced by reviewing the following rules with the class members:

1. General conduct.

a. When working with a job case, remove it completely from the storage area and place it on a table top.

b. Return all tools, equipment and type to their respective places.

c. Never operate machinery if unsure of the correct procedure.

d. Exercise care when using developing chemicals.

e. Use proper eye protective devices when working with chemicals.

f. Pick up any type that may have fallen to the floor.

2. Dark room.

a. Turn on the ventilator fan when in the darkroom.

b. Chemicals should not be stored in glass bottles on high shelves; they may fall and cause injury.

c. Goggles and apron should be worn when preparing chemical solutions. Always add acid to water - never water to acid.

d. Tongs or rubber gloves should be used in handling film in the developing process.

e. Students who have skin allergies must wear rubber gloves while handling film or mixing chemicals.

f. Keep hands away from face while working in the darkroom.

g. Wash hands carefully after developing film.

h. Portable electrical devices should not be used around or within reaching distance of sinks.

i. No unsafe conduct will be tolerated in the darkroom.

j. All spills should be wiped up immediately.

3. Equipment.

a. Air brush.
   1. Have instructor connect and disconnect regulators to high pressure air line.
   2. Do not adjust regulators.
   3. Take care not to spray toward other students' faces.

b. Dry mount.
   1. Use caution to avoid being burned by the press or tacking iron.
   2. Dry mount with heat setting prescribed by the instructor.
   3. Turn off and unplug press and tacking iron at end of the process.
   4. Do not lay hot tacking iron down on papers or on the countertop. Return it to holder.
   5. Inform instructor about worn electrical cords and plugs.
   6. Never test heat of press or tacking iron by touching either one.

c. Engraving.
   1. Eye protection must be worn when engraving.
   2. Keep hands from under cutter bit.
   3. The instructor will change or adjust engraving cutters.

d. Folding machine.
   1. Never attempt to remove a misfed or jammed sheet while the machine is running.
   2. Turn off the power when making changes.
   3. Keep all tools off the tables of the folder.

e. Paper drill.
   1. Beaware that drill hit may he hot.
   2. Keep hands away from drill area while drilling.
   3. Keep area around operating pedal clear at all times.

f. Platemaker.
   1. Disconnect the platemaker before changing carbons or making adjustments. Be careful of hot carbons when changing them.
   2. Never look at arc lights during operations.
   3. Be careful not to break glass of vacuum frame.

g. Process camera.
   1. Do not touch hot lights.
   2. Avoid flashing lights in students' eyes.
   3. Caution should be exercised around glass copy board.

h. Rubber stamp and gold stamping.
   1. Exercise caution when using heating element.
   2. Keep work surface clean at all times.
   3. Do not throw or drop type.
   4. Never test heat by touching.
   5. Turn off and unplug press at the end of the process.

i. Sign press.
   1. Do not throw or toss type.
   2. Utilize caution to keep hands out of roller.
   3. Use only specified cleaning solutions in cleaning type and press.
   4. Do not lift or carry press during cleanup.

j. Stripping tables.
   1. All foreign material should be kept off the glass so it will not be broken.
   2. Keep fingers out of cutting area when cutting a flat.
   3. The cutting devices should be kept sharp and stored properly.

k. Thermography.
   1. Dark goggles must be worn in this area when heating the relief powder.
   2. Students in the area are not to stare at the heat lamp when it is on.
   3. Do not leave area when the lamp is on and refief powder is heating. (Fire may occur if lamp is unattended.)

## Metalworking Safety Rules

Many of the tools and materials used in the metals laboratory are heavy, sharp, brittle, awkward to handle,or explosive. Consideration should be given to the following rules when presenting safety instruction in this area:

1. General conduct.

   a. Eye protective devices must be worn when working in the laboratory.

   b. Loose clothing and jewelry are not to be worn.

   c. A person working on a machine is not to be disturbed.

   d. All tools, equipment and materials are to be returned to their proper storage areas after being used.

   e. Area is to be cleaned up by student who worked there.

   f. Work area is to be kept free from scraps of metal stock.

2. Tools, materials and equipment.

   a. Keep metal cutting tools sharp.

   b. Check all tools that will be used to see if they are functioning properly.

   c. Never carry tools in pockets.

   d. Grind mushroom heads and burrs off of cold chisels, center punches and other damaged small hand tools.

   e. Use a fixture or a clamp to hold the stock while it is being machined.

   f. Wear leather gloves when handling hot metals.

   g. Exercise caution when using portable power hand tools, spot welders, electric shears, etc.

   h. Never use electrical tools around flammable vapors, gases,or materials.

   i. Always keep machine guards in place.

   j. Stop a machine before making adjustments, oiling or checking measurements.

   k. Never touch the surface of a metal while it is being machined.

   l. Use a small brush to clean off metal chips.

   m. Wear protective clothing when working with hot metals.

   n. Wear a face shield with spectacles or goggles when there is danger of flying chips.

3. Compressed gases.

a. Always know the characteristics of the gas being used.

b. Read the label of each cylinder. There is no standard color code for compressed gas bottles.

c. Treat compressed gas cylinders with respect.

d. Cylinders are not to be moved without the use of a hand cart.

e. All compressed gas cylinders must be kept upright at all times.

f. All gas cylinders must be secured and stored erect at all times.

g. Gas cylinders are to be stored in a well-ventilated area separated by a fire resistant barrier from other areas - preferably outdoors.

h. When moving or storing cylinders, cylinder caps must be in place.

i. Be sure that hoses, valves and regulators are tightly secured and in good repair.

j. Shut off valves and regulators when not in use.

k. Never use oil on any oxygen valve or regulator equipment.

l. Always have instructor check setup before opening any valve.

m. Always work in a well-ventilated area.

4. Foundry.

a. Wear proper protective clothing when handling molten metal: safety glasses and face shield or helmet, apron, leggings, and approved gloves. (Tennis shoes or sandals are not acceptable.)

b. Always treat crucibles, flasks, castings, and other equipment as if they are hot. (Check to see if they are hot before picking them up.)

c. Ask instructor to check mold before closing it. Be sure it is not too damp before pouring - it could explode.

d. Keep flammable materials away from the foundry area.

e. Light the furnace only under the supervision of the instructor. (Follow the manufacturer's directions and the posted procedure for lighting the furnace.)

f. Before removing crucible, shut off the gas first, then the air. Use a crucible lifter to remove crucible from furnace.

g. Carry molten metal as close to the floor as possible in a two-person pouring tool.

h. Keep water and wet items away from the pouring area of the foundry. (Moisture and molten metal combined can cause an explosion.)

i. The foundry pouring area floor should be protected with sand to prevent accident "floor explosions" caused by spills of molten metal.

j. In consumable pattern casting (styrofoam), keep the sprue basin filled to prevent firing. Turn on foundry area ventilation fan. Do not breathe the fumes.

k. In hot-shell or $CO_2$-shell molding, the two halves of the mold should be securely fastened and banked in a flask of green sand to dissipate the heat. Do not breathe the fumes.

Woodworking Safety Rules

Student use of wood cutting, chipping, scraping and fabricating tools and equipment must be prefaced with instruction in their proper care and handling. In addition to the specific safety rules for hand tools, the following rules are recommended for consideration:

1. General conduct.

   a. Eye protective devices must be worn when working in the laboratory.

   b. Recommended safety procedures for each power tool and machine are to be followed.

   c. Tight fitting clothing is to be worn.

   d. Long sleeves are to be rolled up.

   e. Loose clothing and jewelry are to be removed.

   f. Safety-toe footwear is to be worn when working with heavy pieces of wood, such as sheets of plywood and two-by-four studs.

   g. Materials are to be stacked neatly in the storage area.

   h. Work areas are to be clean and free from small scraps, excessive sawdust and oil.

   i. Nails are to be extracted from boards that have been removed for remodeling.

   j. Tables of machines and other work surfaces are to be kept free of nails, tools, and materials.

k. Materials are not to be moved past a person who is using a power tool or machine.

l. A person using a power tool or machine is not to be spoken to or otherwise startled.

m. Machines are not to be started or stopped for someone else (except in an emergency). (Follow the machine operator's instructions when helping someone.)

n. All hand tools are to be sharp and in good working order before being used.

o. Sharp-pointed tools are to be carried with the sharp edges away from the body. Never put them in pockets.

p. A small piece of wood, when it is being cut, is not to be held by the fingers.

q. Guards provided on machines are always to be used. (If a standard guard cannot be used, use a holding and clamping device and a push stick.)

r. Work should be planned before beginning machine operation. (If large stock is to be cut, arrange for help before it is needed, not afterwards.)

s. Disconnect the machine before attempting to change a blade or before any adjusting or oiling.

t. Goggles and face shield are to be worn if there is a danger of flying chips.

u. First aid treatment is to be sought for even the slightest injury.

v. Hearing protective devices, such as ear plugs or ear muffs, are to be worn if excessive noise is a problem.

w. The location of the fire extinguisher (with proper extinguishing agent for wood, flammable liquids, and/or electrical fires) shall be known to all students.

x. All finishing materials are to be returned to, and stored in, metal containers and cabinets.

y. All oily rags are to be placed in an approved metal container.

z. Machines or power tools are not to be used if the operator is tired or in a hurry.

2. Finishing room.

a. All oily rags are to be placed in a closed metal container.

b. Spray booths and dip tanks are to be cleaned immediately after using.

c. All containers of finishing materials and solvents are to be kept covered.

d. A respirator is to be worn, if needed.

e. Storage containers are to be closed by first wiping out the lip and then sealing the lid tightly.

f. All flammable liquids are to be returned to a metal storage cabinet.

g. Working surfaces are to be cleaned immediately after using.

h. The ventilation system should be checked to see that it is on.

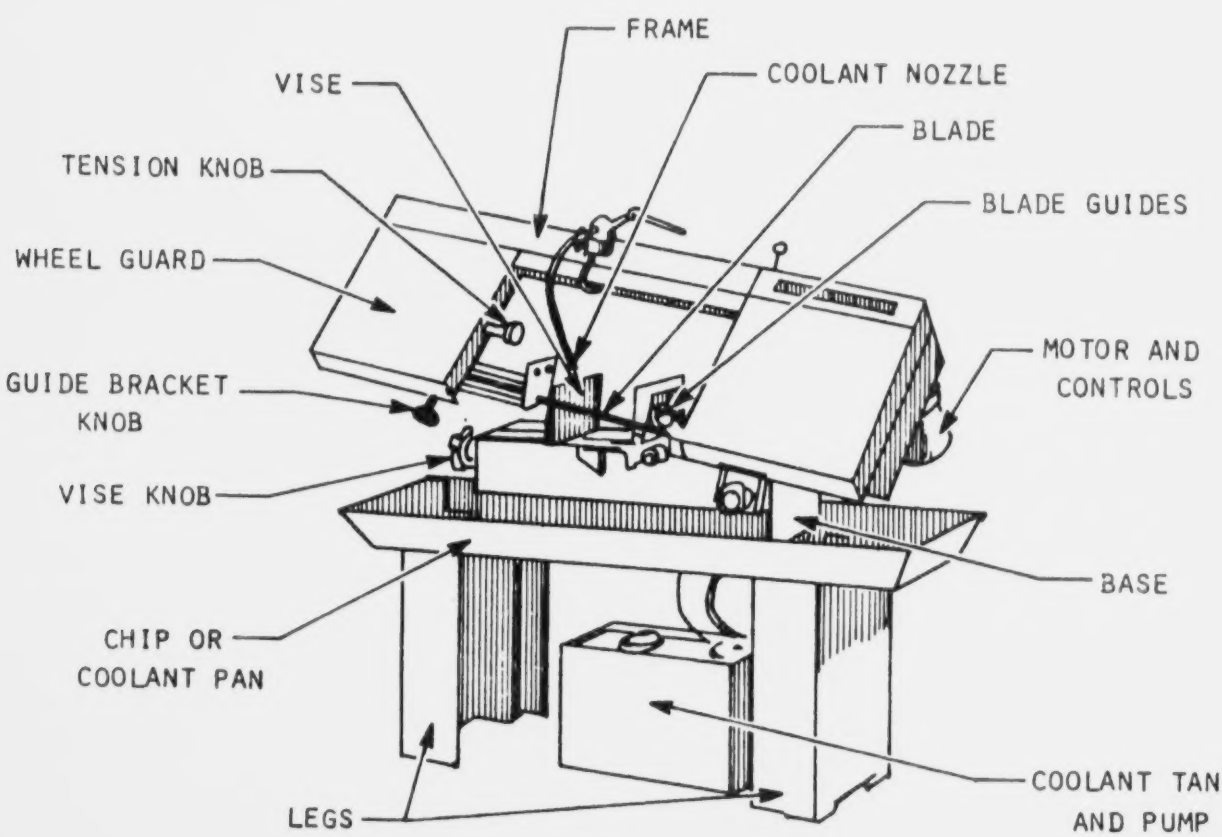
i. The finishing area is not to be used for sanding, rubbing,or polishing.

# EQUIPMENT
# INSTRUCTION SHEETS
# AND
# EVALUATIONS

# Horizontal Band Saw

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. MAKE ALL ADJUSTMENTS TO GUARDS, BLADE GUIDES, ETC. BEFORE TURNING ON THE POWER.
2. BEFORE STARTING THE SAW, BE SURE THE BLADE IS UP AND OUT OF CONTACT WITH THE STOCK.
3. ADJUST FEED RATE SO THE BLADE DOES NOT BOUNCE OR PLUNGE INTO THE WORK WHEN STARTING THE CUT.
4. STOCK SHOULD BE PROPERLY POSITIONED AND TIGHTLY SECURED IN A VISE. ANGLE IRON SHOULD BE CLAMPED WITH THE RIDGE UP.
5. DO NOT PUSH DOWN ON THE SAW TO ADD PRESSURE TO THE BLADE.
6. KEEP HANDS AWAY FROM THE CUTTING AREA. BRUSH AWAY CHIPS WITH A BRUSH WHEN THE MACHINE IS TURNED OFF.
7. IF THE MATERIAL REQUIRES COOLANT, BE SURE THE SYSTEM IS WORKING AND THE CORRECT COOLANT IS USED.



NAME _____

DATE _____ GRADE _____

# Horizontal Band Saw

SAFETY QUIZ

CIRCLE ONE

1. HANDS SHOULD NEVER BE IN THE CUTTING AREA WHILE THE MACHINE IS ON. T F

2. IT IS SAFE TO APPLY SLIGHT PRESSURE TO THE SAW FRAME TO INCREASE THE SPEED OF THE CUTTING ACTION. T F

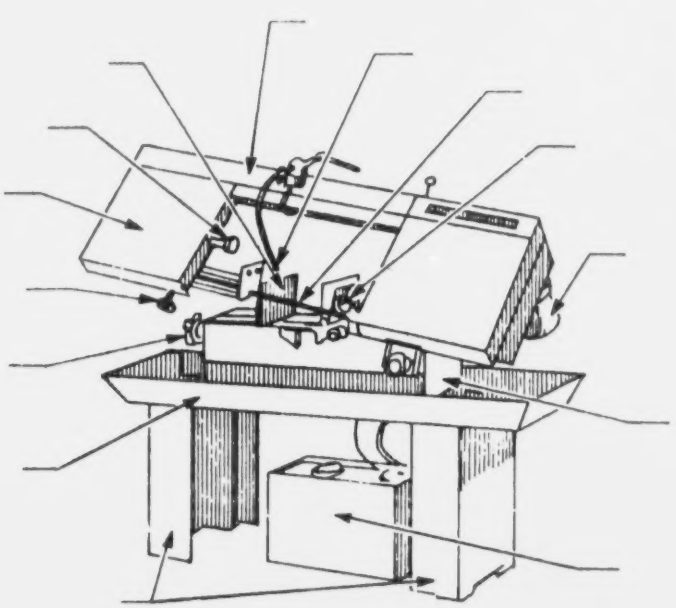
3. BLADE GUIDES SHOULD BE ADJUSTED TO THE BLADE AND TO THE SIZE OF THE WORK PIECE OR VISE. T F

4. CHIPS SHOULD BE REMOVED ONLY WHEN THE MACHINE IS STOPPED. T F

5. BE SURE THE BLADE IS ON THE STOCK WHEN TURNING ON THE MACHINE. T F

6. THE WORK PIECE MUST BE PROPERLY POSITIONED IN THE VISE, IN ADDITION TO JUST BEING SECURELY HELD. T F

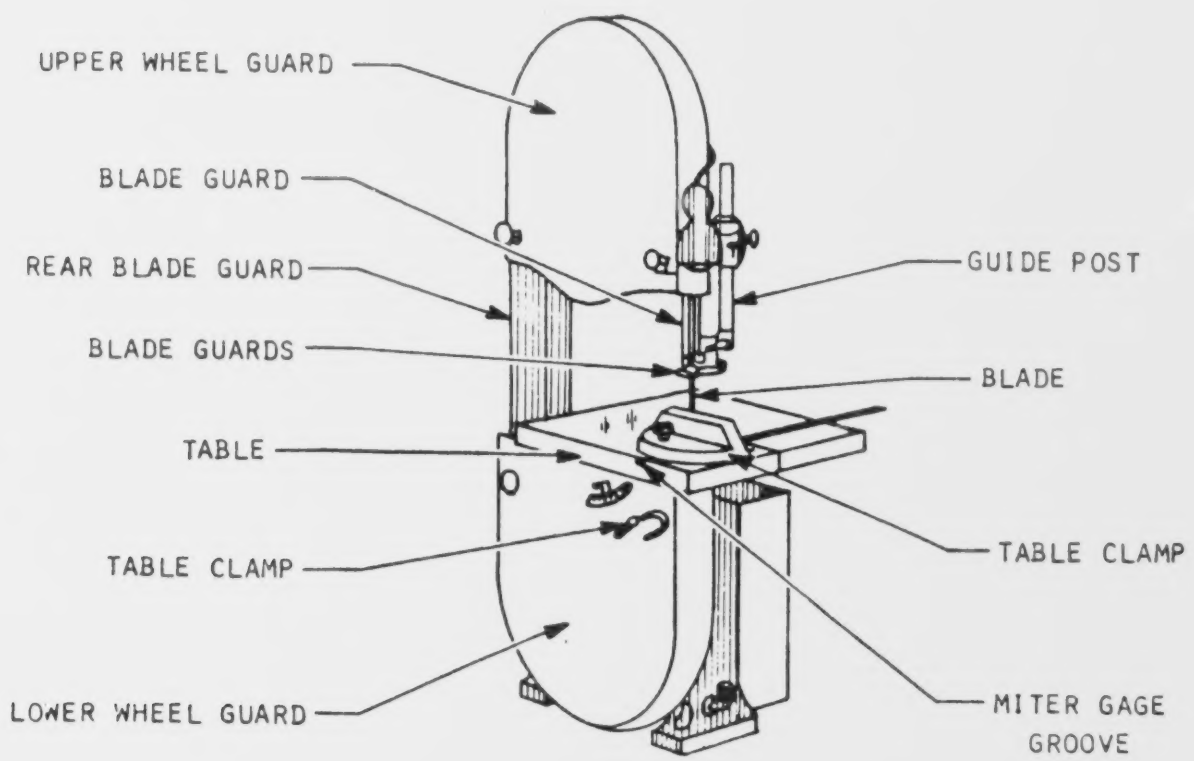
IDENTIFY PARTS



# Vertical Band Saw

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. ADJUST BLADE GUIDES, ¼" ABOVE THE STOCK, BEFORE THE POWER IS TURNED ON.
2. GUIDE THE WORK SLOWLY, LETTING THE MACHINE DO THE WORK. DO NOT FORCE THE WORK INTO THE BLADE.
3. SHARP CURVES SHOULD BE CUT WITH A NARROW BLADE OR BY FIRST CUTTING RELIEF CUTS.
4. AVOID BACKING OUT OF A CUT.
5. PLACE FINGERS OF HANDS ON EACH SIDE OF THE CUT LINE, NEVER ON THE LINE. USE A SCRAP PUSH BLOCK IF NECESSARY.
6. IMMEDIATELY SHUT OFF THE POWER IF THE BAND SAW BLADE BREAKS WHILE THE MACHINE IS IN OPERATION.
7. CYLINDRICAL STOCK MUST NOT BE CUT WITHOUT THE USE OF A V-BLOCK.
8. NEVER REACH AROUND THE BAND SAW BLADE TO REMOVE WORK.
9. DO NOT LEAVE THE MACHINE UNTIL IT HAS COME TO A FULL STOP.



NAME _____

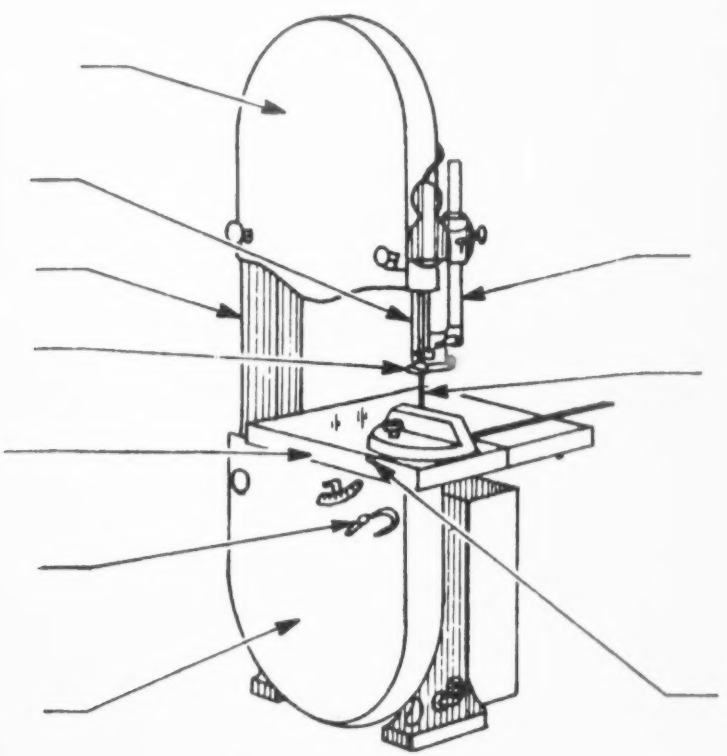
DATE _____ GRADE _____

# Vertical Band Saw

SAFETY QUIZ — CIRCLE ONE

1. IF THE WORK DOES NOT CUT EASILY, YOU SHOULD PUSH HARDER. T F
2. THE UPPER BLADE GUIDE SHOULD BE ¼" ABOVE THE STOCK. T F
3. ADJUSTMENTS ARE TO BE MADE WHILE THE POWER IS OFF. T F
4. THE HANDS SHOULD COME NO CLOSER THAN 2" FROM THE BLADE. T F
5. HANDS SHOULD BE IN BACK OF THE CUTTING LINE. T F
6. BACKING OUT THE WORK SHOULD BE AVOIDED. T F
7. THE MACHINE CAN BE STOPPED BY FORCING A PIECE OF WOOD INTO THE BLADE. T F

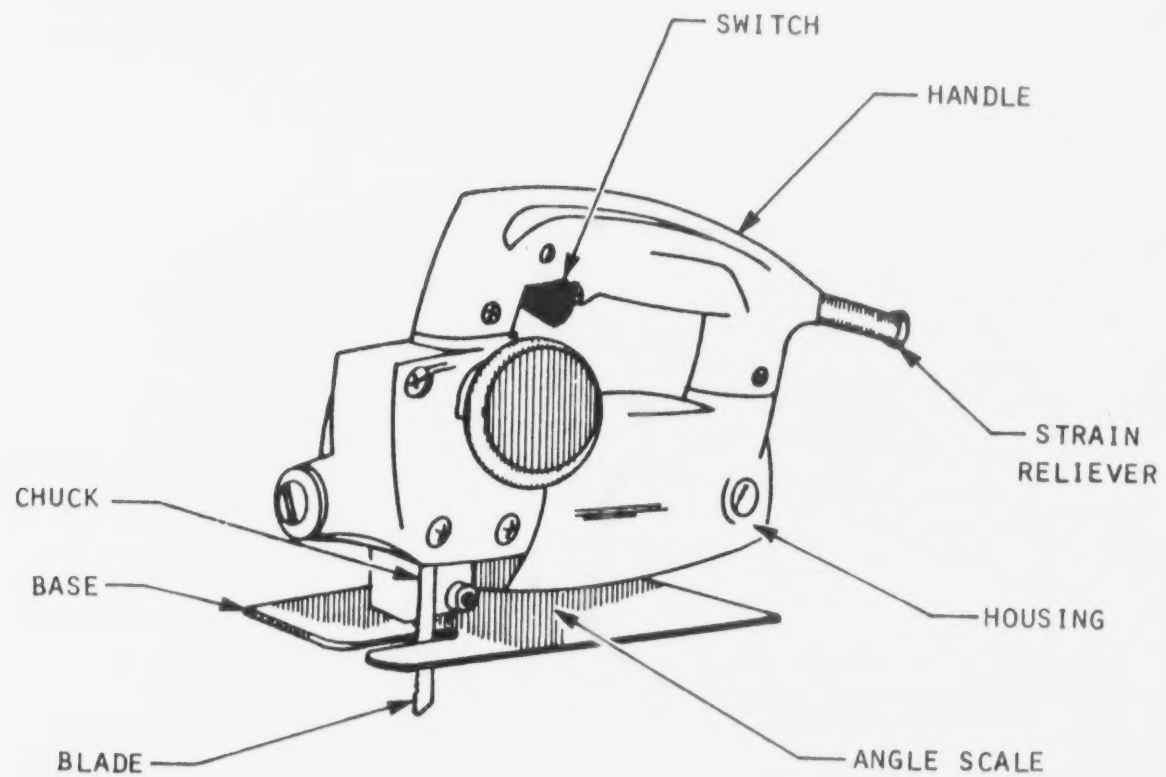
IDENTIFY PARTS



# Bayonet Saw

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. SELECT THE CORRECT BLADE FOR THE STOCK, AND CLAMP TIGHTLY IN THE CHUCK.
2. ALWAYS DISCONNECT THE SAW TO CHANGE BLADES OR MAKE ADJUSTMENTS.
3. USE VISE OR CLAMPS TO SECURELY HOLD STOCK TO BE CUT.
4. KEEP CUTTING PRESSURE CONSTANT, DO NOT FORCE THE BLADE INTO THE WORK.
5. DO NOT ATTEMPT TO CUT CURVES SO SHARP THAT THE BLADE WILL BE TWISTED.
6. THE SAW MUST NOT BE SET DOWN ON THE BENCH UNTIL IT HAS COMPLETELY STOPPED.



NAME _____

DATE _____ GRADE _____

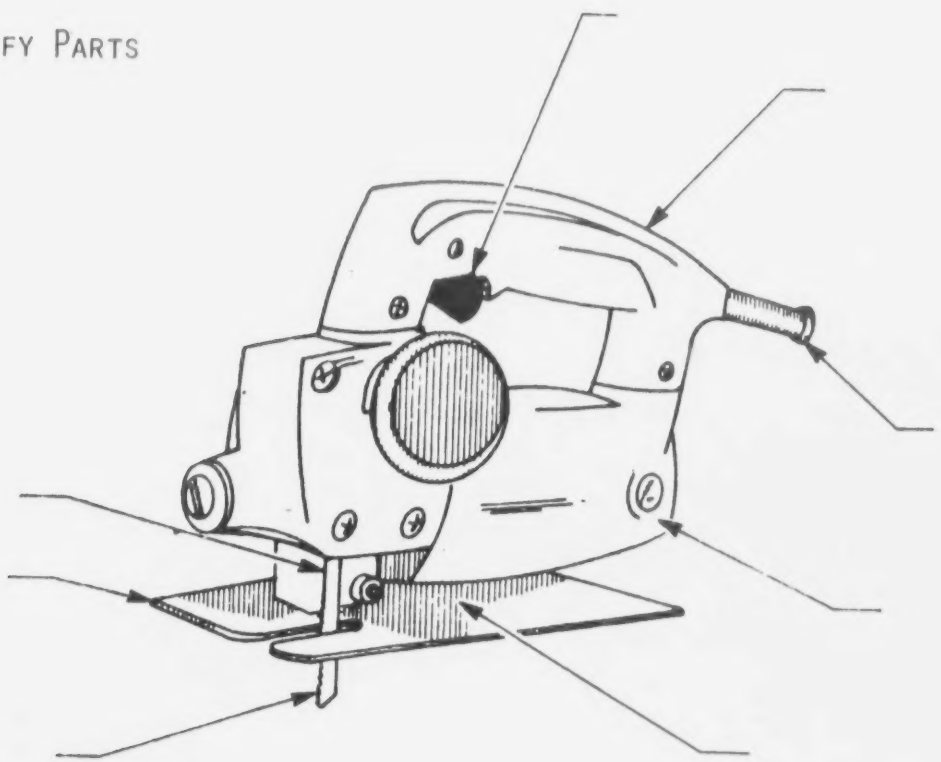
# Bayonet Saw

SAFETY QUIZ

CIRCLE ONE

1. ANY BLADE MAY BE USED TO CUT ANY MATERIAL. T F
2. TO STORE THE SAW THE BLADE AND THE REAR OF THE BASE MAY BE USED FOR SUPPORTS. T F
3. THE BASE SHOULD ALWAYS BE HELD FLAT AGAINST THE WORK. T F
4. ALLOW THE SAW TEETH TO DO THE CUTTING - NOT EXCESSIVE FORCE. T F
5. SECURE ALL WORK BEFORE CUTTING. T F

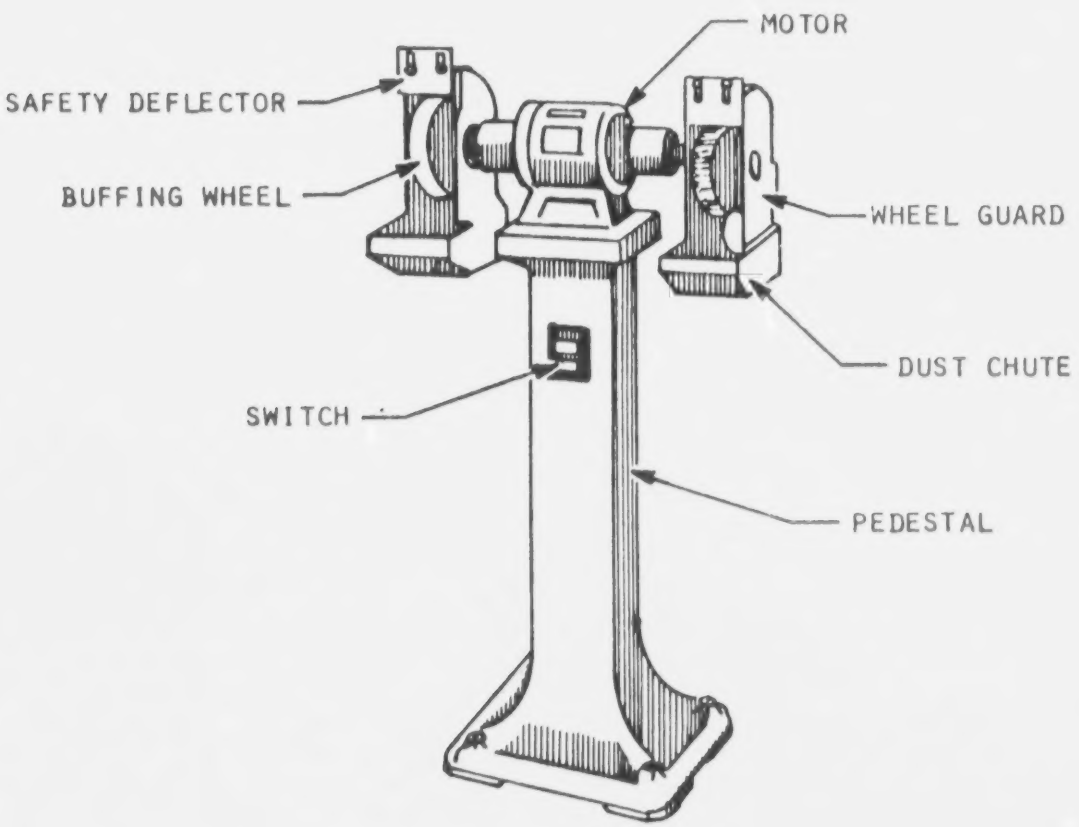
IDENTIFY PARTS



# Buffer

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. HOLD WORK SECURELY USING BOTH HANDS.
2. STAND TO ONE SIDE OF THE WHEEL WHEN BUFFING OR APPLYING COMPOUND.
3. ALWAYS BUFF USING THE LOWER HALF OF THE BUFFING WHEEL.
4. PRESS MATERIAL AGAINST WHEEL WITH ONLY SUFFICIENT PRESSURE TO CAUSE THE WHEEL TO POLISH THE MATERIAL.
5. USE CARE WHEN BUFFING AROUND CORNERS OR OPENINGS WHERE THE WHEEL COULD GRAB AND THROW THE WORK PIECE.
6. NEVER BUFF A LEADING EDGE.
7. NEVER USE GLOVES, RAGS, OR PART OF A SHOP COAT TO HOLD THE WORK PIECE.
8. KEEP HANDS AWAY FROM THE WHEEL WHILE IT IS IN MOTION.



NAME _____

DATE _____ GRADE _____

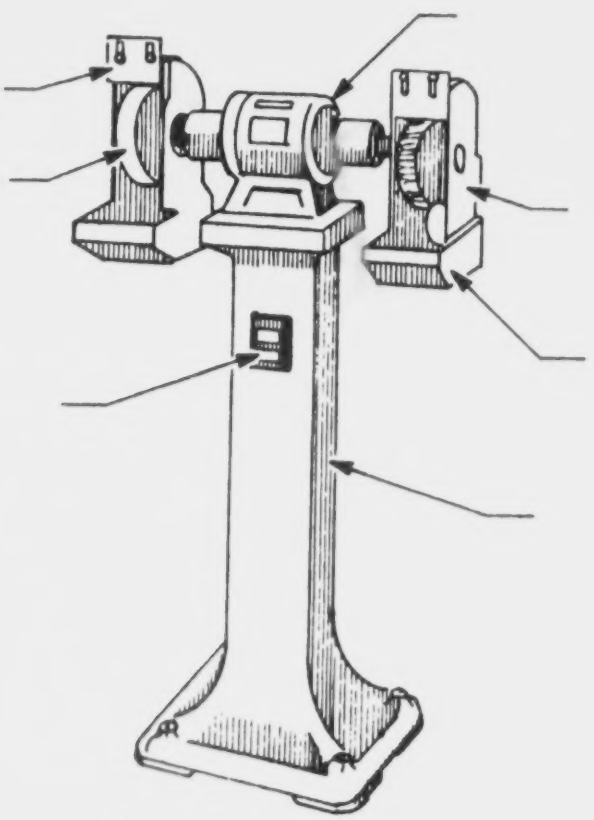
# Buffer

SAFETY QUIZ

CIRCLE ONE

1. THE MORE PRESSURE WHEN BUFFING THE BETTER. T F
2. LOOSE CLOTHING OR HAIR SHOULD BE SECURED. T F
3. BUFFING CAN BE DONE ON THE UPPER HALF OF THE WHEEL. T F
4. GLOVES, SHOP APRONS, OR RAGS ARE TO BE USED TO HOLD THE MATERIAL WHEN IT GETS HOT. T F
5. USE CAUTION ON OPENINGS AND CORNERS. T F
6. WIRE SHOULD BE BUFFED VERY CAREFULLY. T F

IDENTIFY PARTS

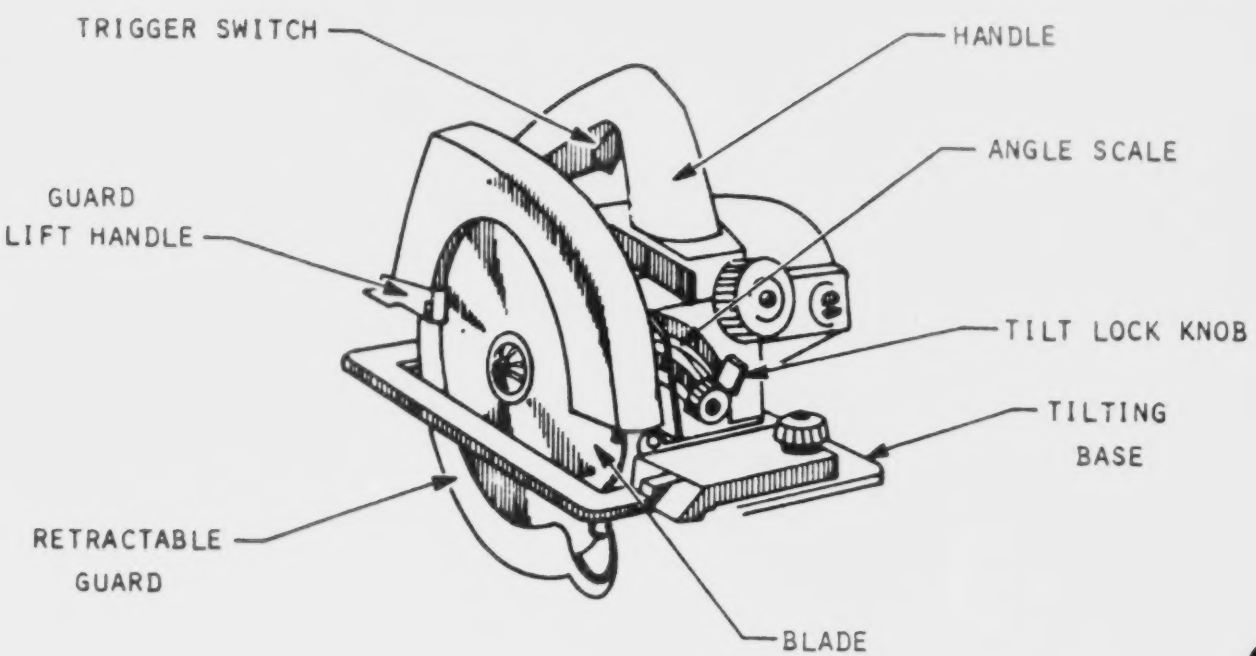


101

# Portable Circular Saw

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. ALL STOCK MUST BE WELL SUPPORTED.
2. ADJUST THE DEPTH OF CUT TO THE THICKNESS OF THE STOCK PLUS 1/8".
3. MAKE SURE THE POWER CORD IS CLEAR OF THE BLADE.
4. CHECK THE BASE AND ANGLE ADJUSTMENTS TO BE SURE THEY ARE TIGHT.
5. ALWAYS PLACE THE SAW BASE ON THE STOCK WITH THE BLADE CLEAR BEFORE TURNING ON THE SWITCH.
6. ADVANCE THE SAW SLOWLY, STRAIGHT THROUGH THE WORK.
7. DO NOT SET SAW DOWN UNTIL THE BLADE STOPS.
8. ALWAYS UNPLUG THE MACHINE TO CHANGE THE BLADES OR MAKE MAJOR ADJUSTMENTS.



NAME _____

DATE _____ GRADE _____

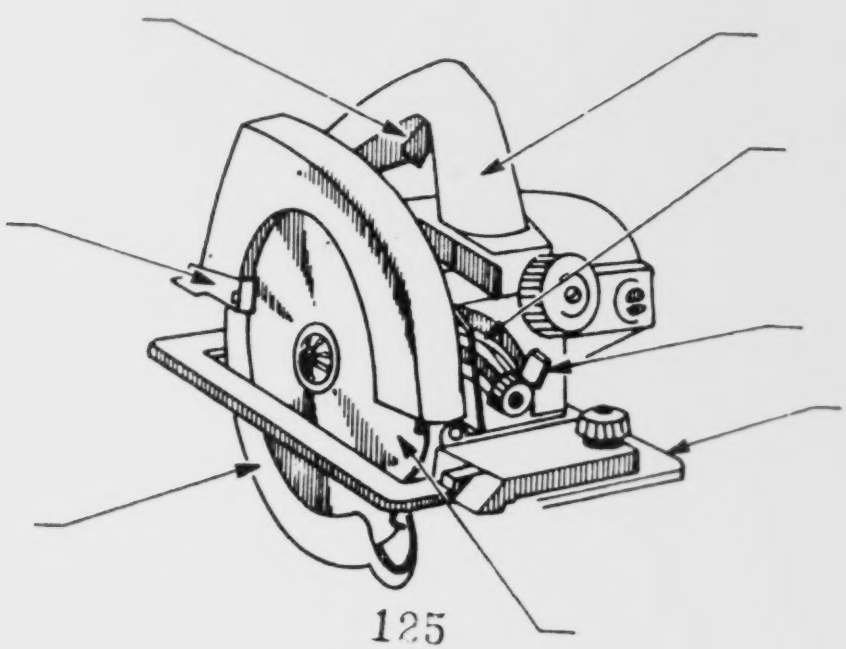
# Portable Circular Saw

## SAFETY QUIZ

CIRCLE ONE

1. THE SAW SHOULD EXTEND 3/4" BELOW THE THICKNESS OF THE WOOD. T F
2. BE SURE THE BLADE HAS STOPPED BEFORE SETTING THE SAW DOWN. T F
3. EYE PROTECTION IS UNNECESSARY WHEN USING THIS TOOL. T F
4. BE SURE THE GUARD COVERS THE BLADE. T F
5. BY TWISTING THE SAW YOU CAN CUT SHARP CURVES. T F
6. THE CORD SHOULD NOT BE IN THE PATH OF THE SAW. T F
7. THE PLUG SHOULD BE REMOVED TO CHANGE THE BLADE. T F

## IDENTIFY PARTS

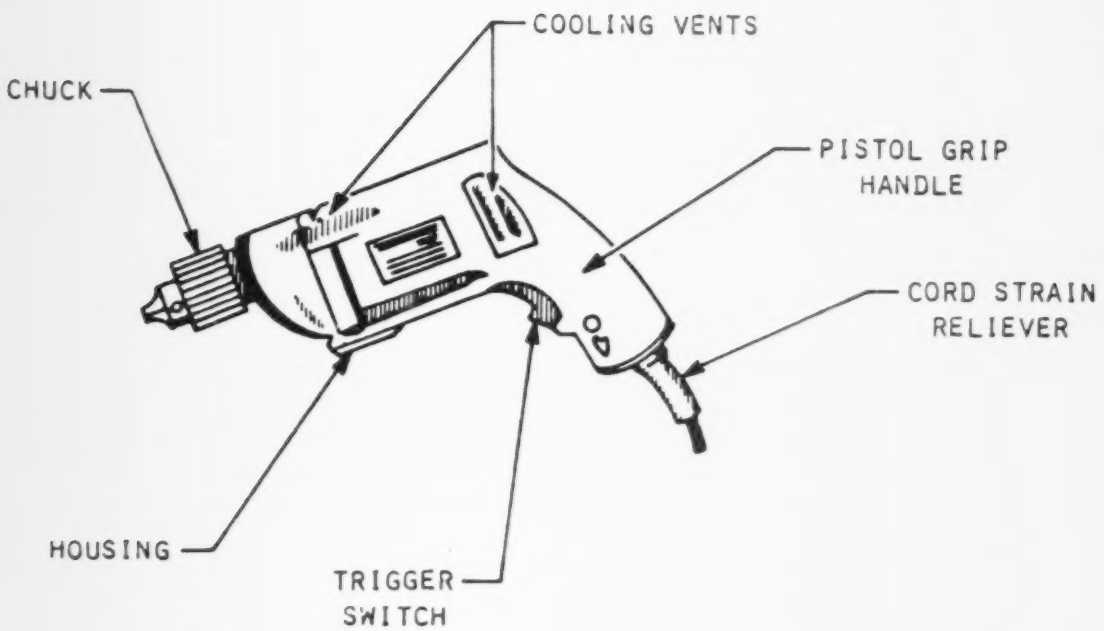


125

# Portable Drill

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. SELECT THE CORRECT DRILL BIT AND MOUNT IT SECURELY TO THE FULL DEPTH OF THE CHUCK.
2. SECURE STOCK TO BE DRILLED SO THAT IT WILL NOT MOVE DURING THE OPERATION.
3. MAKE SURE THE SWITCH IS "OFF" AND CHUCK KEY REMOVED BEFORE CONNECTING TO POWER SOURCE.
4. MARK HOLE LOCATION WITH CENTER PUNCH (METAL) OR AWL (WOOD) BEFORE DRILLING.
5. DRILL WITH A STRAIGHT, EVEN, STEADY PRESSURE.
6. WHEN DRILLING DEEP HOLES, WITHDRAW THE DRILL SEVERAL TIMES TO CLEAR THE CUTTINGS.



NAME _____

DATE _____ GRADE _____

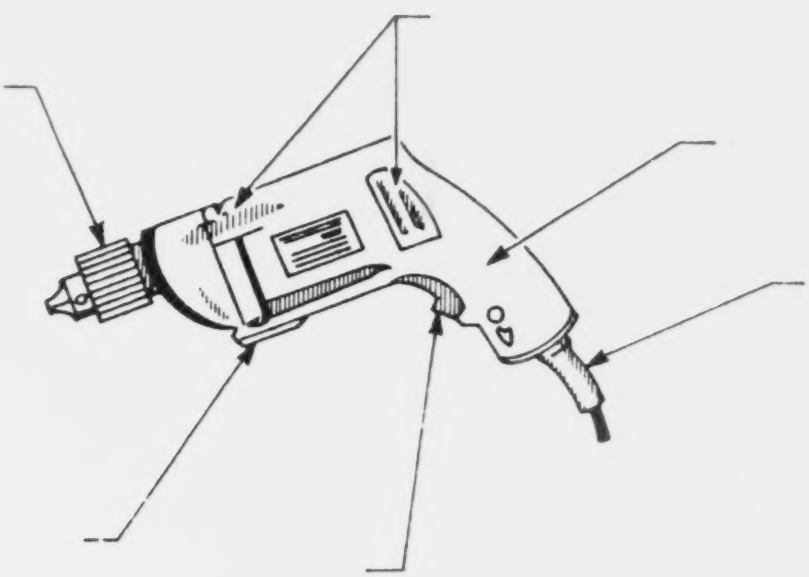
# Portable Drill

SAFETY QUIZ

CIRCLE ONE

1. HOLES SHOULD BE CENTER PUNCHED FIRST. T F
2. THE DRILL SHOULD BE UNPLUGGED TO CHANGE A BIT. T F
3. CARRY THE DRILL BY THE CORD. T F
4. EVEN, STEADY PRESSURE SHOULD BE USED WHEN DRILLING. T F
5. ALL WORK SHOULD BE CLAMPED SECURELY WHEN DRILLING. T F
6. BE SURE TRIGGER SWITCH IS "OFF" BEFORE PLUGGING IN THE POWER. T F

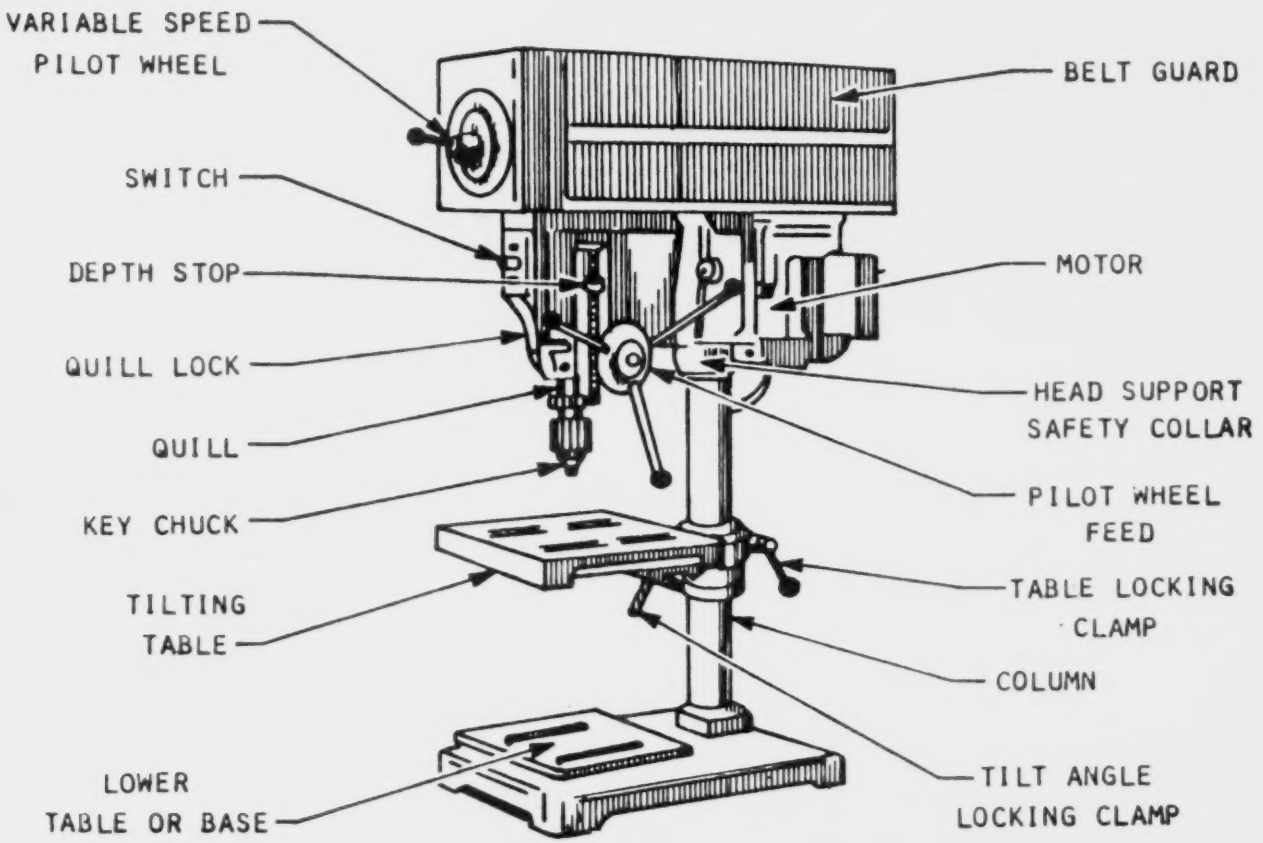
IDENTIFY PARTS



# Drill Press

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. CLAMP WORK IN A VISE OR FASTEN TO THE TABLE.
2. BE SURE THAT KEYS, DRIFTS, AND WRENCHES ARE ALL REMOVED BEFORE TURNING ON THE MACHINE.
3. USE A "V-BLOCK" FOR ROUND OR IRREGULAR-SHAPED STOCK.
4. SELECT A PROPERLY SHARPENED BIT. FOR METAL, CENTER PUNCH WHEN A HOLE IS TO BE DRILLED.
5. TURN OFF POWER IF STOCK IS CAUGHT IN THE DRILL. DO NOT STOP BY HAND.
6. ADJUST TABLE OR DEPTH STOP TO AVOID DRILLING INTO THE TABLE.
7. SELECT THE CORRECT SPEED, NORMALLY SLOWER FOR METAL - FASTER FOR WOOD. THE LARGER THE BIT, THE SLOWER THE SPEED.
8. REMOVE THE CHIPS AND SHAVINGS WITH A BRUSH, NOT WITH THE HANDS.



NAME _____

DATE _____ GRADE _____

# Drill Press

SAFETY QUIZ

CIRCLE ONE

1. REMOVE CHUCK KEY BEFORE TURNING ON THE MACHINE. T F

2. SHAVINGS AND WASTE MATERIAL SHOULD BE REMOVED FROM THE TABLE WITH YOUR HANDS. T F

3. THE POWER MUST BE OFF TO ADJUST THE VARIABLE SPEED. T F

4. BE SURE TO SELECT THE CORRECT SPEED FOR DRILLING INTO EACH DIFFERENT MATERIAL. T F

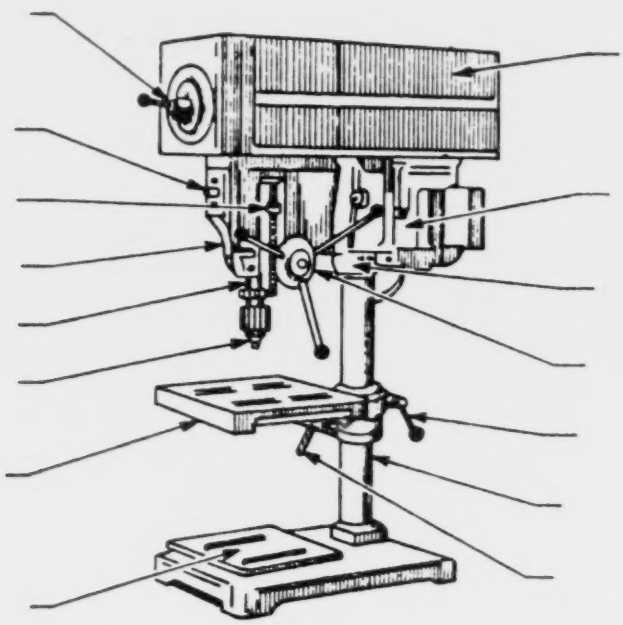
5. A CENTER PUNCH IS USED TO LOCATE THE CENTER OF THE HOLE TO BE DRILLED. T F

6. FINE ADJUSTMENTS ARE MADE WHILE THE MACHINE IS RUNNING. T F

7. THE POWER SHOULD BE TURNED OFF IF A WORK PIECE IS CAUGHT IN THE DRILL. T F

8. WEARING JEWELRY AND LOOSE CLOTHING IS PERMISSABLE WHEN OPERATING THE DRILL PRESS. T F

IDENTIFY PARTS



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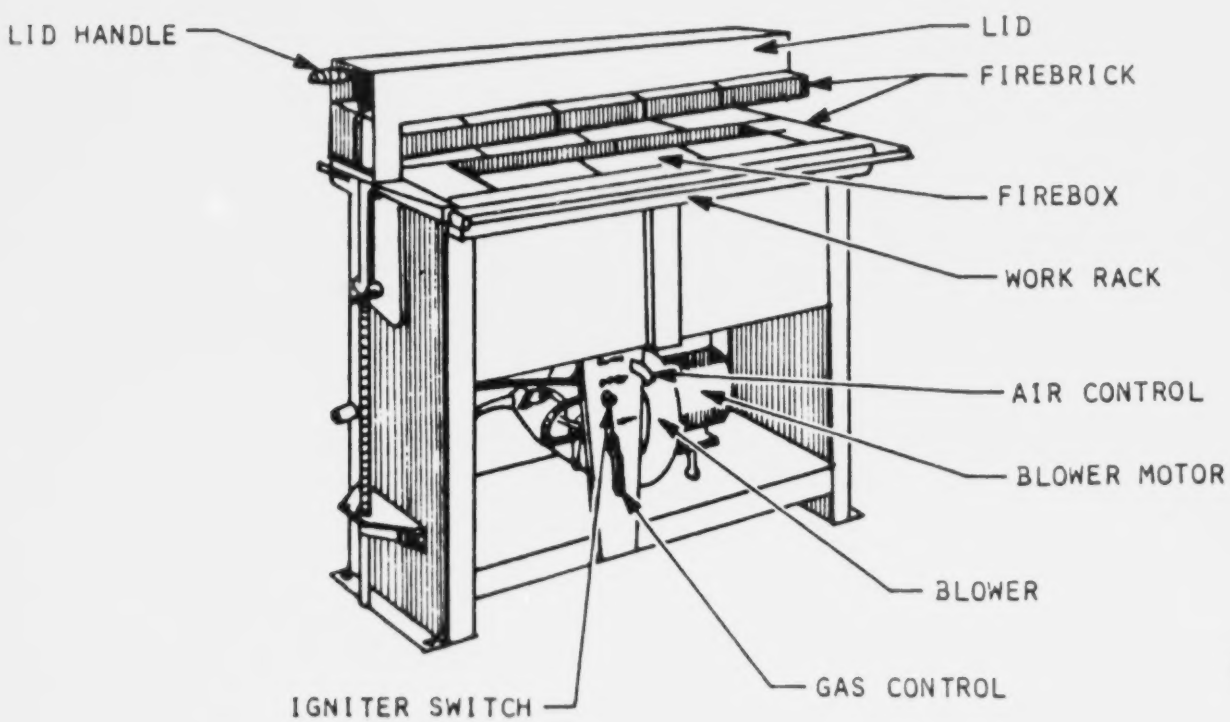
# Gas Forge

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. CLEAR AREA OF ALL FLAMMABLE MATERIAL. BE SURE THE AREA IS WELL-VENTILATED.
2. KEEP TOP OPEN WHILE LIGHTING.
3. FOLLOW ALL SEQUENTIAL INSTRUCTIONS FOR IGNITING GAS AND AIR.
4. USE TONGS OR PLIERS TO HANDLE HOT METAL.
5. CONSIDER ALL METAL AROUND THE FURNACE AS BEING HOT.
6. WEAR LEATHER GLOVES WHEN HANDLING HOT MATERIAL.
7. UNATTENDED HOT METAL SHOULD BE PLACED IN A MARKED "HOT" DESIGNATED AREA.
8. STAND SO THAT YOUR FACE IS PROTECTED WHEN QUENCHING METAL.
9. SHUT OFF "GAS" FIRST AND "AIR" LAST WHEN FINISHED USING THE FORGE. BE SURE VALVES ARE TIGHTLY TURNED OFF.
10. QUENCH HOT TONGS BEFORE PUTTING THEM AWAY.



NAME _____

DATE _____ GRADE _____

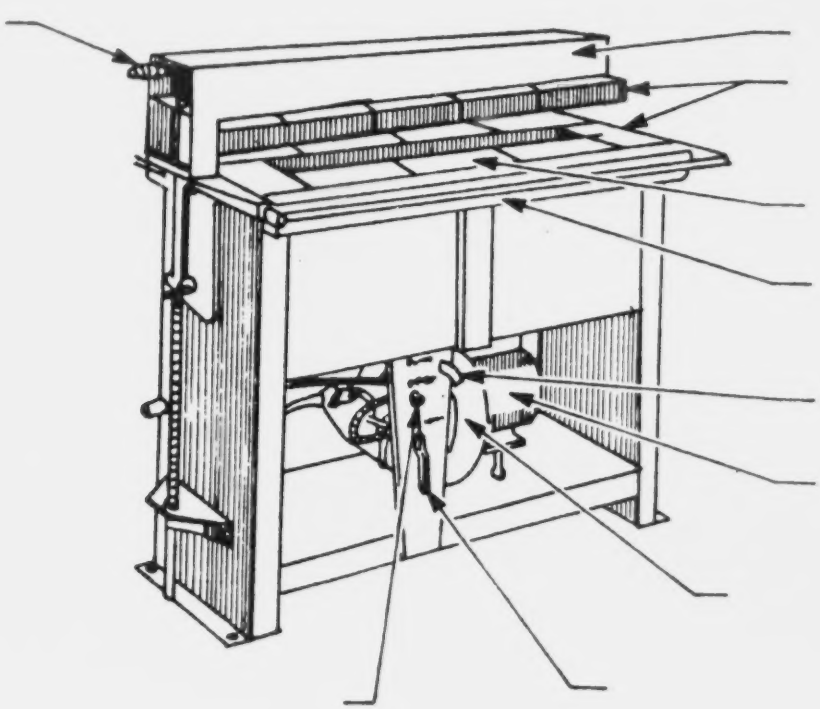
# Gas Forge

SAFETY QUIZ

CIRCLE ONE

1. FORGE AREA MUST BE CLEARED OF ALL FLAMMABLE MATERIALS. T F
2. GLOVES SHOULD BE WORN WHENEVER HANDLING HOT METAL. T F
3. HOT METAL SHOULD BE PLACED IN A "HOT" AREA. T F
4. THE AIR SHOULD BE THE FIRST THING OFF. T F
5. THE TOP SHOULD BE CLOSED WHILE IGNITING THE FORGE. T F
6. TONGS ARE NECESSARY TO HANDLE HOT METAL. T F

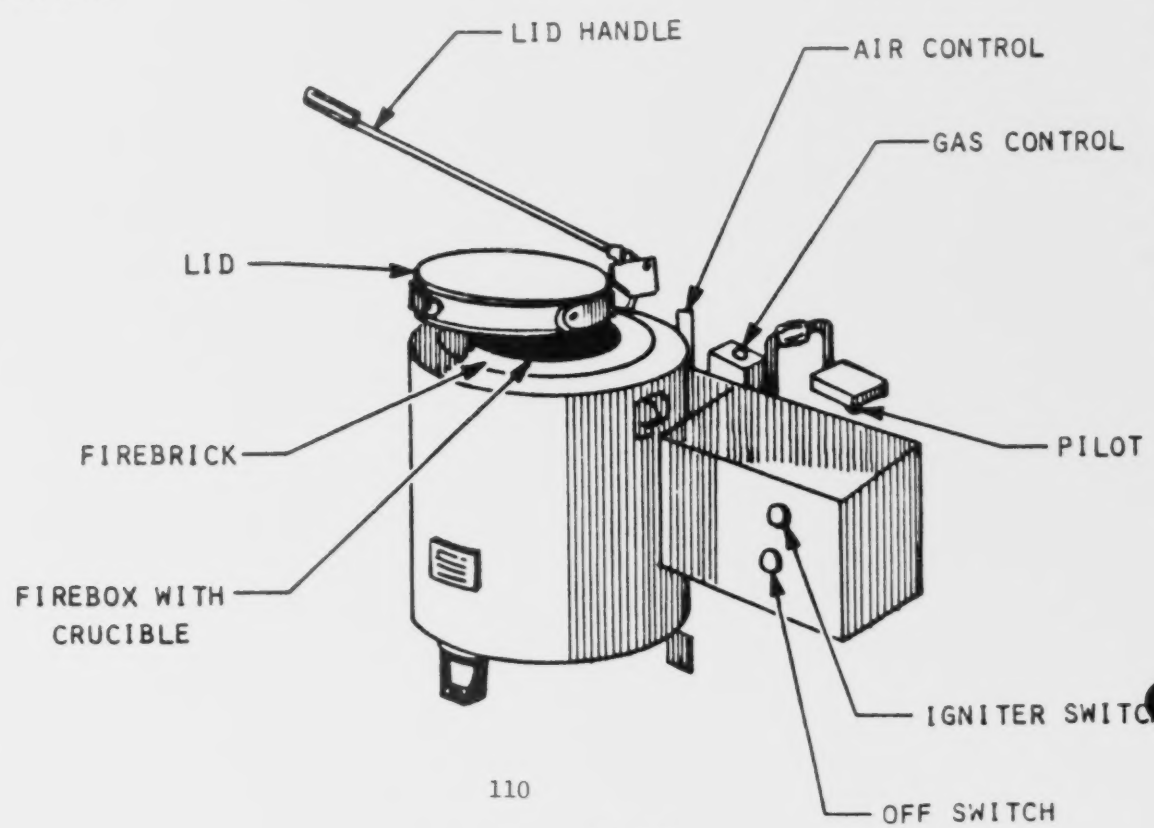
IDENTIFY PARTS



# Crucible Furnace

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. PROTECTIVE CLOTHING MUST BE WORN - COATS - GLOVES - FACE SHIELD - SHOES - LEG PROTECTORS.
2. KEEP ALL FLAMMABLE MATERIAL AWAY FROM THE WORKING AREA.
3. PREHEAT COLD METAL BEFORE PLACING IN THE CRUCIBLE. DO NOT THROW METAL IN CRUCIBLE, USE TONGS.
4. PLACE MOLD ON FLOOR BEFORE POURING METAL.
5. MOVE CAUTIOUSLY AND CARRY MOLTEN METAL CLOSE TO THE FLOOR TO REDUCE POSSIBLE DANGERS.
6. STAND SO THAT YOUR FACE IS PROTECTED WHEN POURING METAL.
7. DO NOT STEP ON HOT MOLTEN METAL.
8. HOT METAL LEFT UNATTENDED SHOULD BE PLACED IN A DESIGNATED AREA AND MARKED "HOT" IN WHITE CHALK.
9. WHEN SHUTTING DOWN - TURN GAS OFF FIRST.



NAME _____

DATE _____ GRADE _____

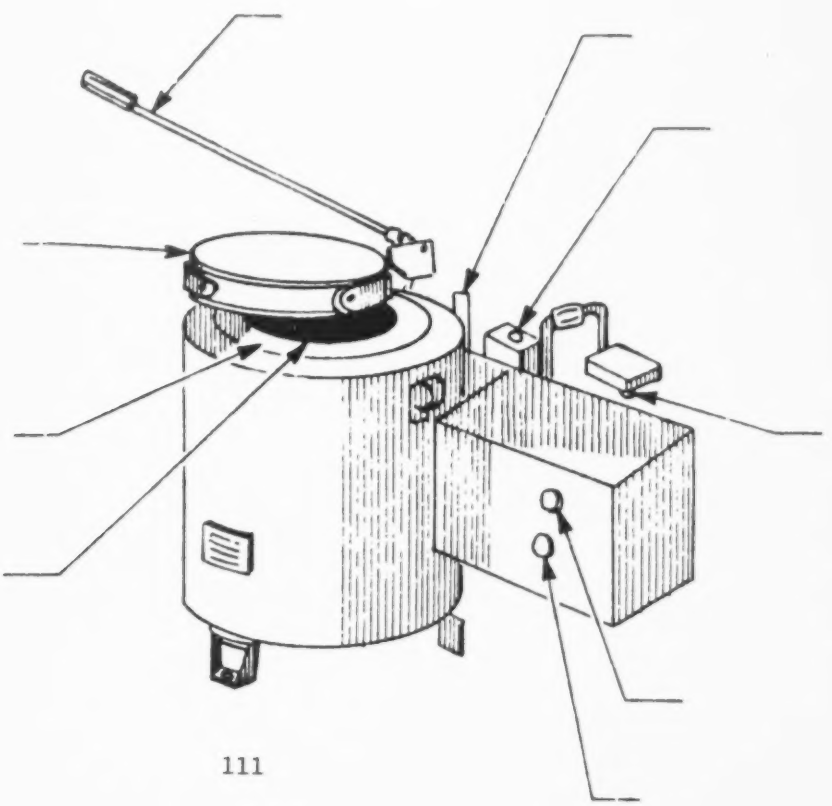
# Crucible Furnace

SAFETY QUIZ

CIRCLE ONE

1. MOVE SLOWLY WHILE POURING. T F
2. AVOID STEPPING INTO HOT METAL. T F
3. LIGHT THE CRUCIBLE WITH THE LID CLOSED. T F
4. A FACE SHIELD IS UNNECESSARY IF YOU WEAR GOGGLES. T F
5. THE GAS IS SHUT OFF LAST. T F
6. TONGS SHOULD BE USED TO ADD METAL TO THE CRUCIBLE. T F

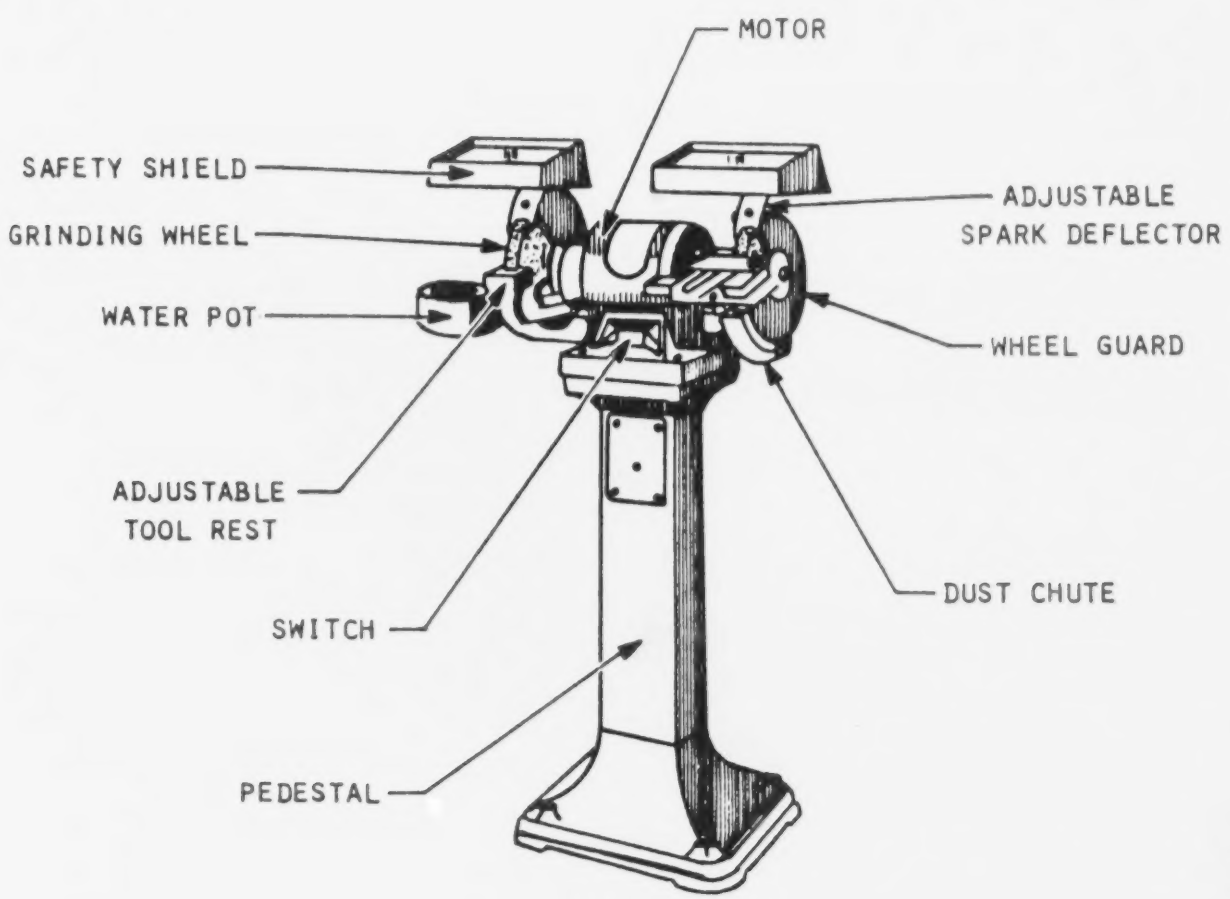
IDENTIFY PARTS



# Grinder

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. SET TOOL REST AND SPARK TONGUE 1/16" TO 1/8" FROM THE WHEEL.
2. HOLD WORK FIRMLY IN HANDS. SMALL PIECES WILL REQUIRE SPECIAL SET-UPS.
3. STAND ON ONE SIDE WHEN STARTING THE MACHINE.
4. USE ONLY THE FACE OF THE WHEEL.
5. PRESS MATERIAL AGAINST THE WHEEL WITH JUST SUFFICIENT PRESSURE TO CAUSE STEADY, EVEN REMOVEL OF METAL.
6. MOVE STOCK ACROSS THE FACE OF THE WHEEL.
7. DO NOT LEAVE THE MACHINE UNTIL THE GRINDING WHEELS HAVE COME TO A COMPLETE STOP.



NAME _____

DATE _____ GRADE _____

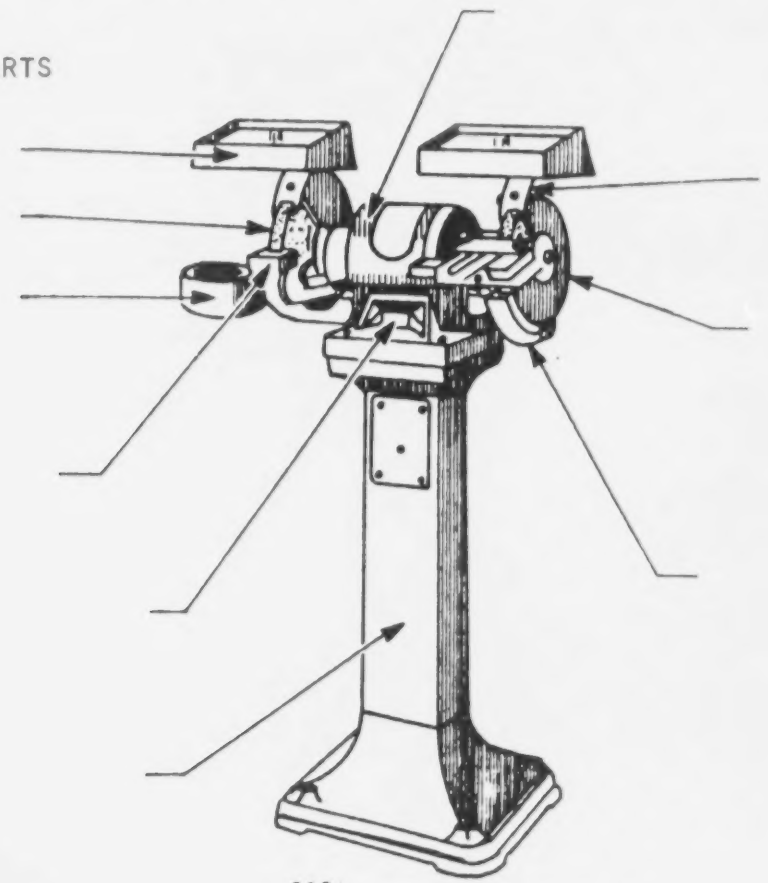
# Grinder

SAFETY QUIZ

CIRCLE ONE

1. ALWAYS STAND TO ONE SIDE WHEN STARTING THE MACHINE. T F
2. THE SAFETY SHIELD REPLACES WEARING GOGGLES. T F
3. "VISE GRIPS" ARE USED TO HOLD SMALL PIECES. T F
4. AN UNBALANCED WHEEL MAY BE USED. T F
5. GUARDS AND TOOL RESTS SHOULD BE ¼" FROM THE WHEEL. T F
6. USING THE SIDE OF THE WHEEL IS PERMISSABLE. T F

IDENTIFY PARTS



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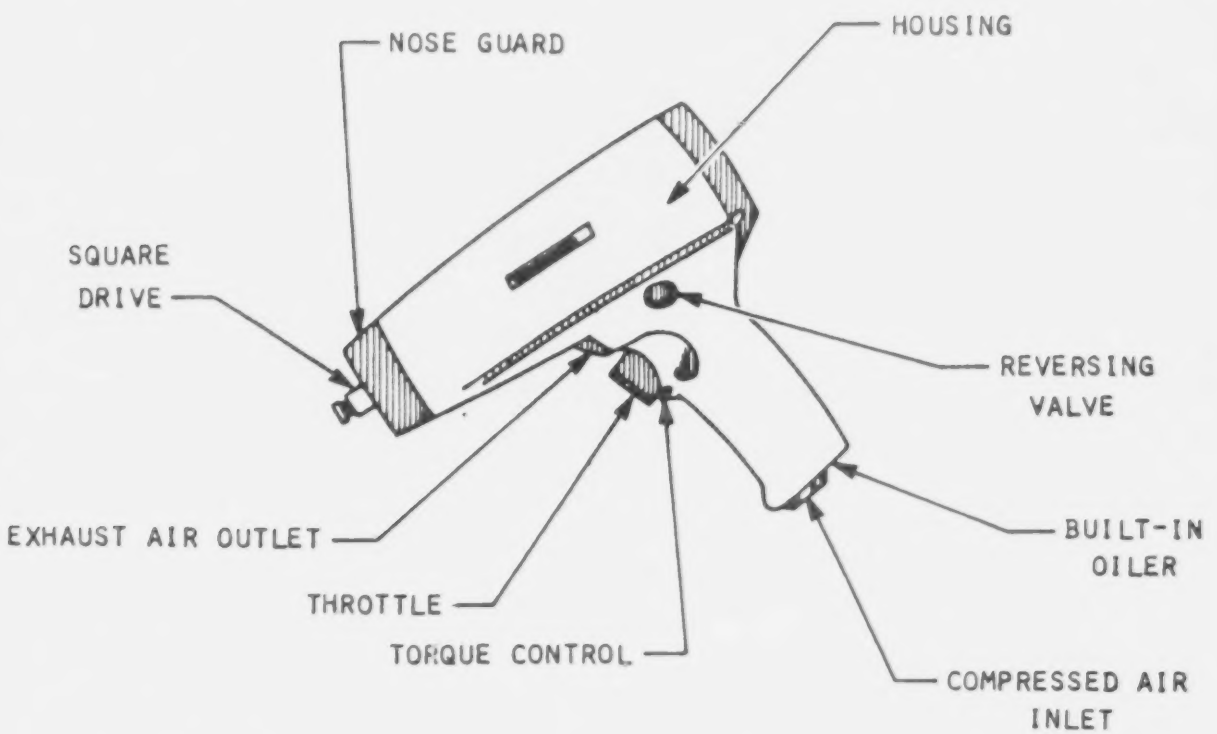
# Impact Wrench

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BE SURE THROTTLE IS IN THE "OFF" POSITION BEFORE CONNECTING TO AIR SUPPLY.
2. USE ONLY SOCKETS DESIGNED FOR USE WITH POWER EQUIPMENT.
3. SECURE ALL WORK WITH CLAMPS OR TIGHTLY IN A VISE.
4. SET TORQUE CONTROL FOR CORRECT TIGHTNESS BEFORE STARTING THE JOB.
5. BE SURE BOTH HANDS ARE FREE TO PROPERLY OPERATE THE IMPACT TOOL.
6. MAINTAIN BALANCE AND FIRM FOOTING AT ALL TIMES.
7. ALWAYS USE THE TOOL IN SHORT BURSTS OF POWER.
8. DISCONNECT AIR LINE WHEN NOT IN ACTUAL USE.



NAME _____

DATE _____ GRADE _____

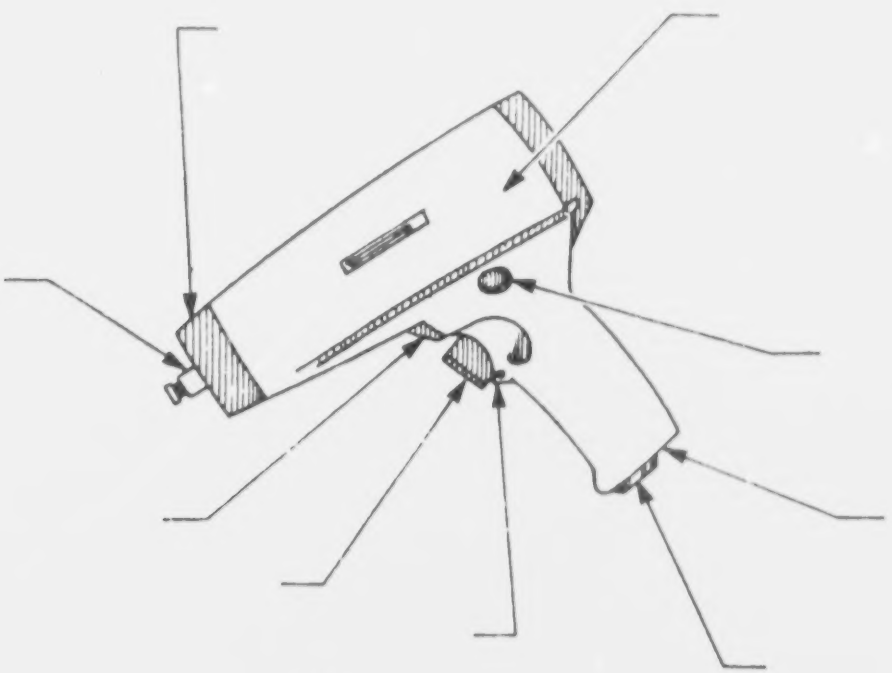
# Impact Wrench

SAFETY QUIZ

CIRCLE ONE

1. BE SURE ALL WORK IS SECURED WITH CLAMPS OR TIGHTLY IN A VISE. T F
2. FIRM FOOTING IS REQUIRED OF THE OPERATOR AT ALL TIMES. T F
3. THE SOCKETS USED MUST BE DESIGNED FOR IMPACT WRENCHES, REGULAR SOCKETS ARE NOT ADEQUATE. T F
4. THE TOOL SHOULD BE DISCONNECTED FROM THE AIR LINE AT THE END OF THE HOSE WHIP, NOT AT THE TOOL. T F
5. THE IMPACT WRENCH MUST BE DISCONNECTED WHEN NOT IN ACTUAL USE. T F
6. SHORT BURSTS OF POWER SHOULD ALWAYS BE USED TO OPERATE THE TOOL. T F

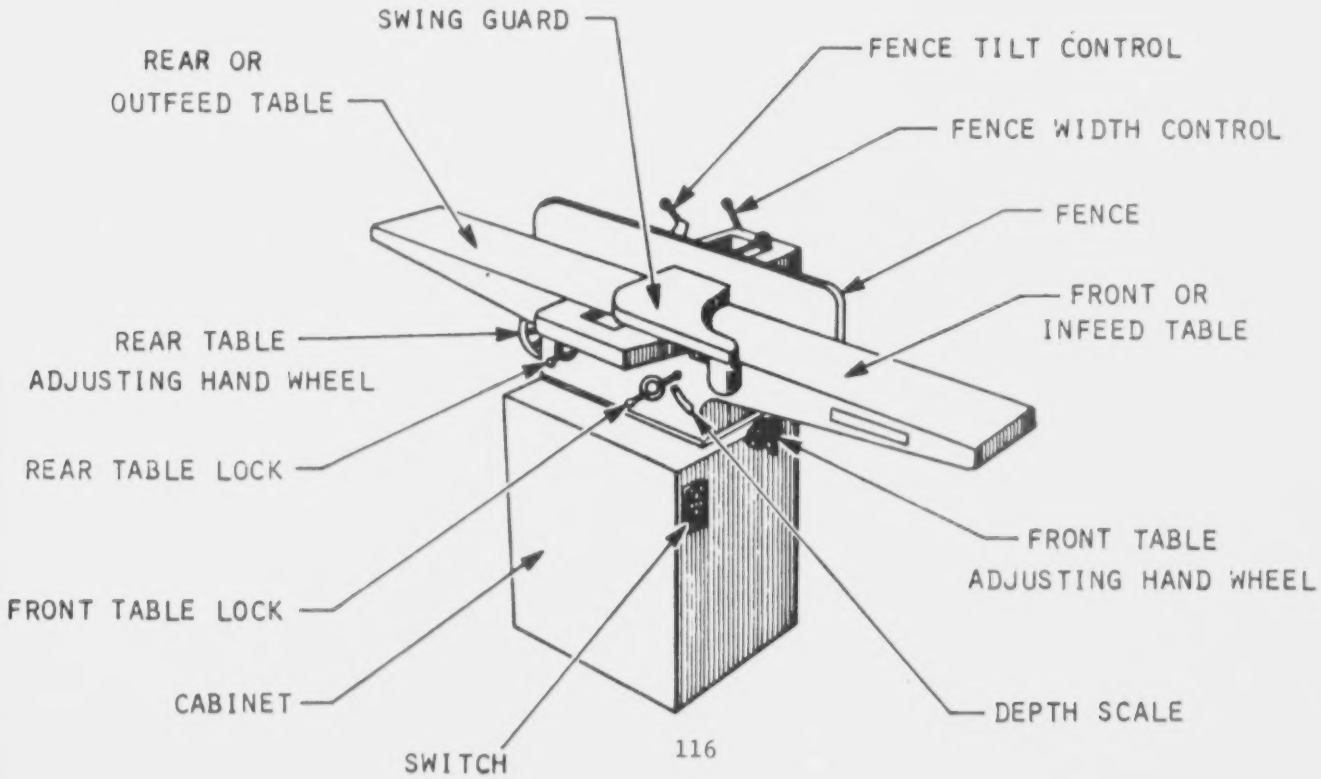
IDENTIFY PARTS



# Jointer

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BEFORE TURNING ON THE MACHINE, MAKE ADJUSTMENTS FOR DEPTH OF CUT AND POSITION OF FENCE.
2. DO NOT ADJUST OUTFEED TABLE OR REMOVE THE GUARD WITHOUT PERMISSION.
3. THE MAXIMUM CUT FOR JOINTING AN EDGE IS 1/8" AND 1/16" FOR SURFACING.
4. THE ABSOLUTE MINIMUM LENGTH OF MATERIAL THAT MAY BE JOINED IS TWICE THE SIZE OF THE KNIVES - 6" JOINTER, 12" PIECE - 8" JOINTER, 16" PIECE.
5. STOCK TO BE SURFACED MUST BE AT LEAST 3/8" THICK UNLESS A SPECIAL FEATHER BOARD IS USED.
6. FEED THE STOCK SO THAT THE KNIVES WILL CUT "WITH THE GRAIN". USE ONLY NEW STOCK THAT IS FREE OF KNOTS, SPLITS AND CHECKS.
7. DO NOT PLANE END GRAIN UNLESS THE BOARD IS AT LEAST 12" WIDE.
8. MAKE SEVERAL CUTS OF 1/16" TO 1/8" INSTEAD OF ONE HEAVY 1/2" CUT.
9. HANDS SHOULD BE KEPT AWAY FROM THE CUTTERHEAD EVEN WHEN THE GUARD IS IN POSITION. MAINTAIN AT LEAST 4" AS A MARGIN OF SAFETY.

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NAME _____

DATE _____ GRADE _____

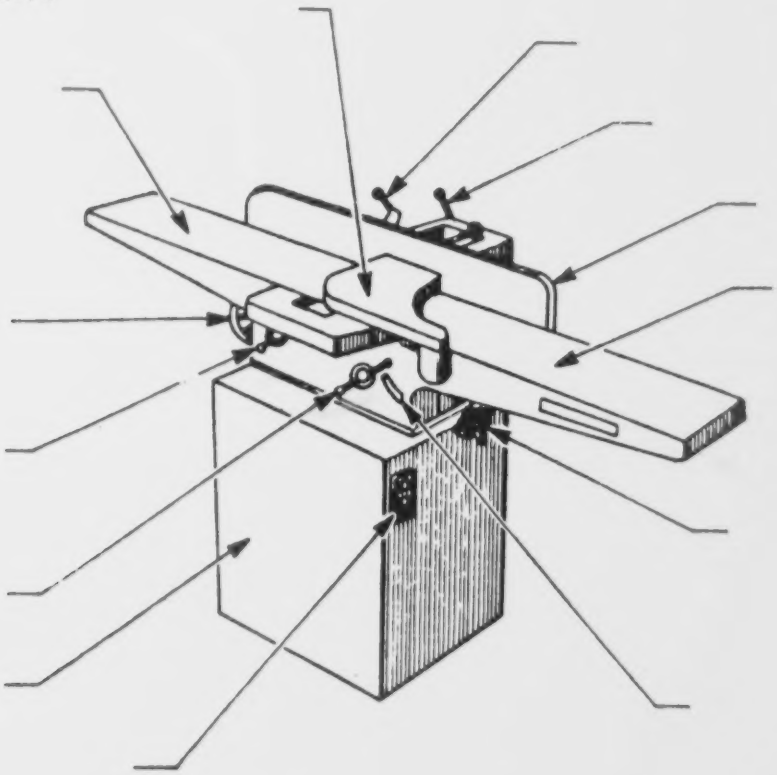
# Jointer

SAFETY QUIZ

CIRCLE ONE

1. MAINTAIN AT LEAST A 2" MARGIN OF SAFETY. T F
2. STOCK SHORTER THAN THE CUTTER SIZE MAY BE PLANED. T F
3. FEED THE STOCK SO THAT THE KNIVES WILL CUT WITH THE GRAIN. T F
4. ACCURATE ADJUSTMENTS CAN ONLY BE MADE WHILE THE MACHINE IS ON. T F
5. ASSISTANCE IS NEEDED FOR LONG STOCK. T F
6. ONLY MAKE ONE CUT NO MATTER HOW THICK. T F

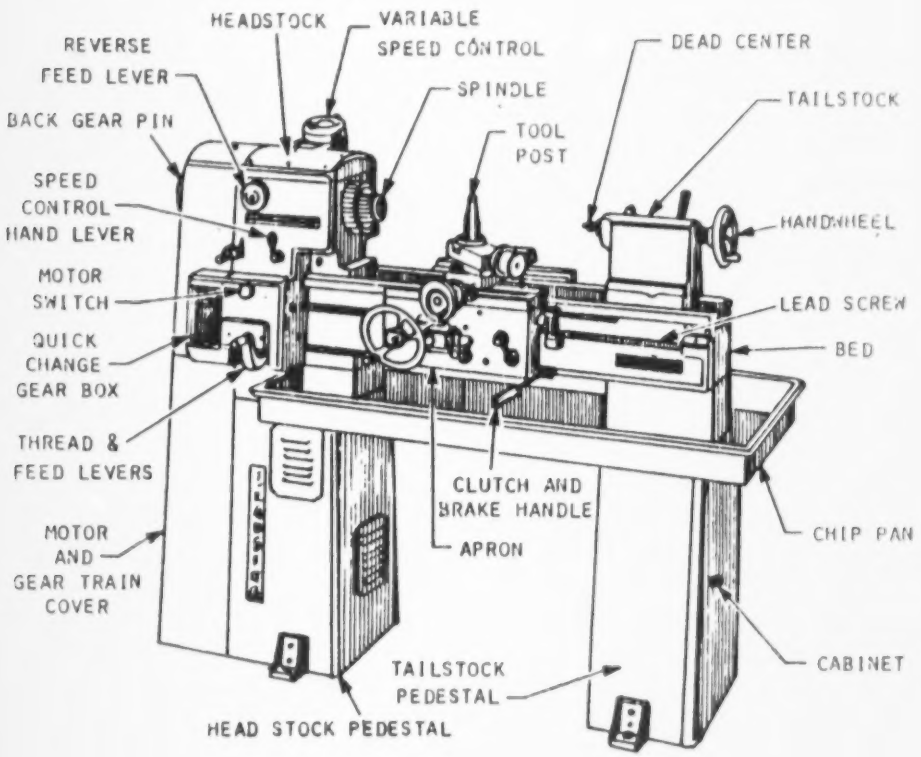
IDENTIFY PARTS



# Metal Lathe

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. NEVER LEAVE CHUCK KEY OR WRENCH IN THE LATHE CHUCK.
2. BE SURE THAT ALL PARTS OF THE CARRIAGE WILL CLEAR ANY ROTATING PART DURING THE FULL LENGTH OF CUT.
3. PLACE HANDS ON THE CONTROLS OR AT YOUR SIDES, EXCEPT WHEN FILING OR POLISHING.
4. MAKE SURE WORK IS SECURE AND LATHE IS SET AT CORRECT SPEED AND FEED BEFORE STARTING CUT.
5. HANDLE CHUCKS AND FACE PLATES CAREFULLY. NEVER ADJUST TOOL BIT WHEN TOOL HOLDER IS HAND HELD.
6. BRING LATHE TO A COMPLETE STOP BEFORE REVERSING.
7. REMOVE TOOL HOLDER AND POST BEFORE FILING OR POLISHING.
8. REMOVE CHIPS WITH A BRUSH, NEVER BY HAND.
9. DO NOT STOP A LATHE CHUCK, ALLOW IT TO COAST TO A STOP. KEEP HANDS AWAY FROM ALL MOVING PARTS.



NAME _____

DATE _____ GRADE _____

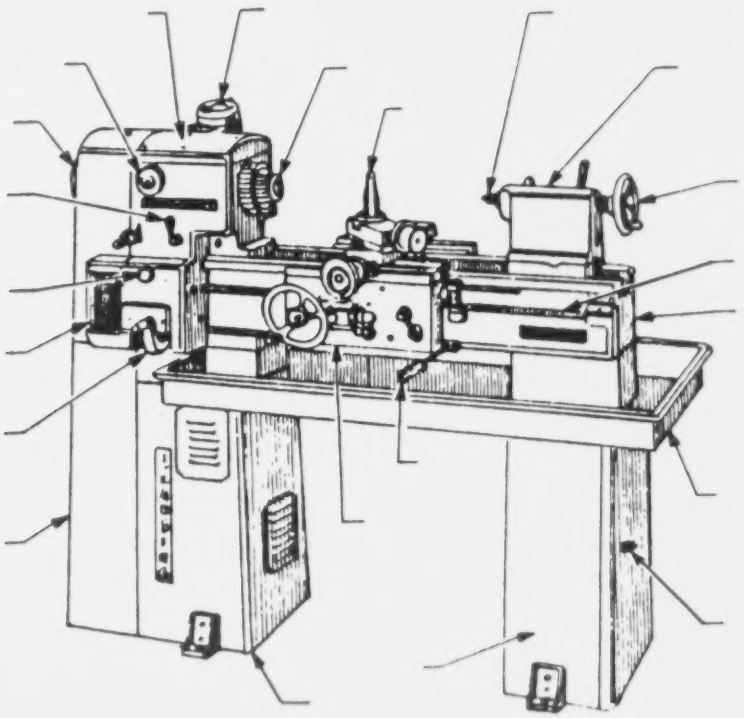
# Metal Lathe

SAFETY QUIZ

CIRCLE ONE

1. A BRUSH SHOULD BE USED TO REMOVE CHIPS. T F
2. MEASUREMENTS MAY BE MADE WHILE THE MACHINE IS ON. T F
3. THE CHUCK KEY MUST BE REMOVED FROM THE CHUCK. T F
4. LUBRICATING BRUSHES SHOULD BE PLACED ON THE CUTTER. T F
5. TOOLS SHOULD BE KEPT ON THE BED. T F
6. YOUR HAND CAN BE USED TO SLOW THE MACHINE WHILE WAITING FOR IT TO STOP. T F
7. TO CHECK FOR CLEARANCES TURN THE CHUCK FIRST BY HAND. T F
8. ALL WORK MUST BE SOLIDLY SUPPORTED. T F

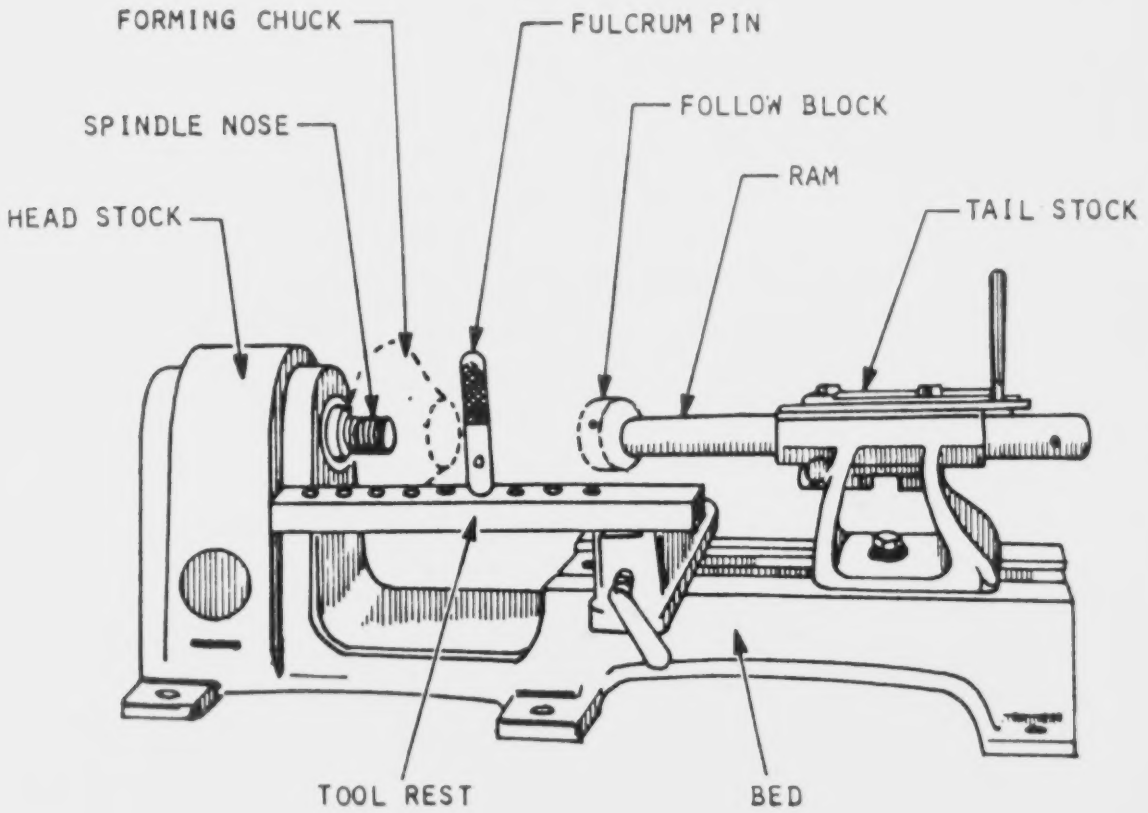
IDENTIFY PARTS



# Spinning Lathe

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BEWARE OF SHARP-POINTED METAL EDGES WHEN CUTTING THE METAL DISC TO SIZE AND WHEN GETTING IT READY FOR SPINNING.
2. BE SURE TOOL REST BASE, TOOL REST, AND FULCRUM PIN ARE SECURELY TIGHTENED IN PLACE BEFORE ATTEMPTING TO SPIN.
3. NEVER STAND IN LINE WITH THE DISC DURING A CENTERING OPERATION.
4. MAKE CERTAIN THE SPINNING TOOLS ARE FITTED SOLIDLY TO THE HANDLE.
5. DO NOT TOUCH A SPINNING DISC BY HAND.
6. USE THE CORRECT TOOL FOR THE OPERATION AND SLOWLY FORCE MATERIAL TO MATCH THE FORMING CHUCK.
7. REMOVE TOOL REST AND PIN WHEN USING STEEL WOOL OR POLISHING.
8. SEEK INSTRUCTOR'S HELP IF IN DOUBT ABOUT A SPECIFIC OPERATION.



NAME _____

DATE _____ GRADE _____

# Spinning Lathe

SAFETY QUIZ

CIRCLE ONE

1. THERE IS REALLY NO DANGER ZONE IN FRONT OF A DISC DURING A CENTERING OPERATION. T F

2. THE SPINNING DISC OR MATERIAL SHOULD NEVER BE TOUCHED BY HAND. T F

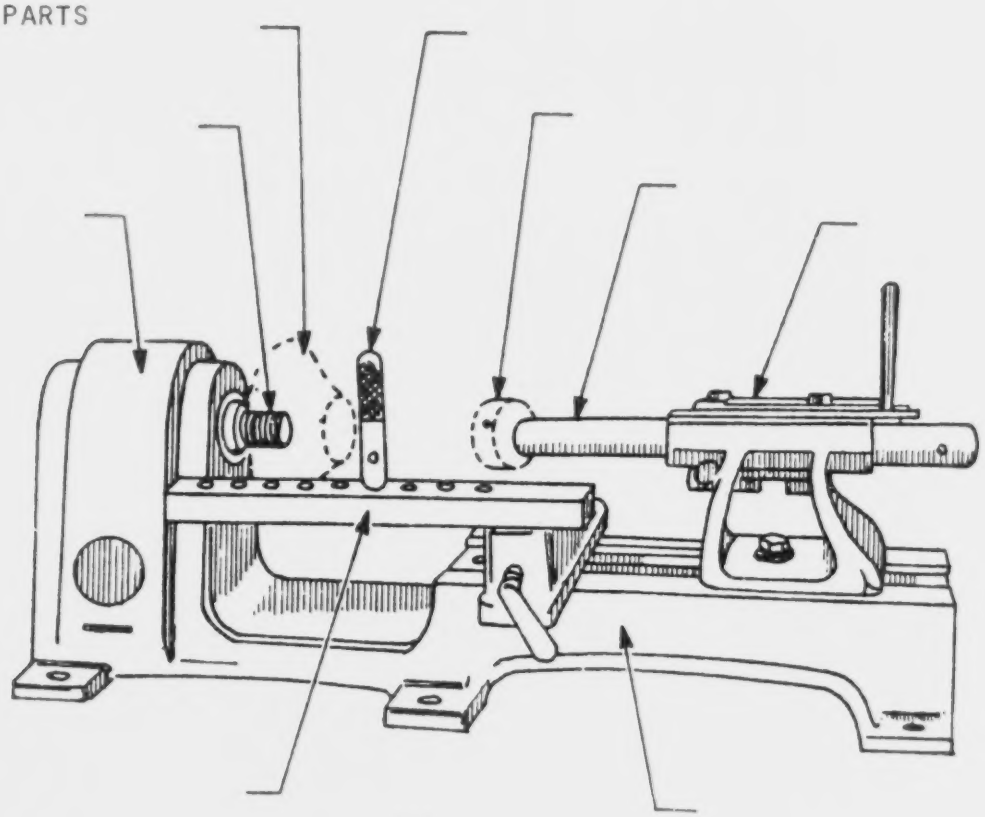
3. SPINNING TOOLS MUST FIT SECURELY IN THE HANDLE. T F

4. EYE SAFETY PROTECTION IS NOT NECESSARY WHEN SPINNING SINCE THERE ARE NO CHIPS. T F

5. THERE IS A CORRECT TOOL FOR EACH OF THE VARIOUS SPINNING OPERATIONS. T F

6. THE TOOL REST NEED NOT BE REMOVED WHEN POLISHING. T F

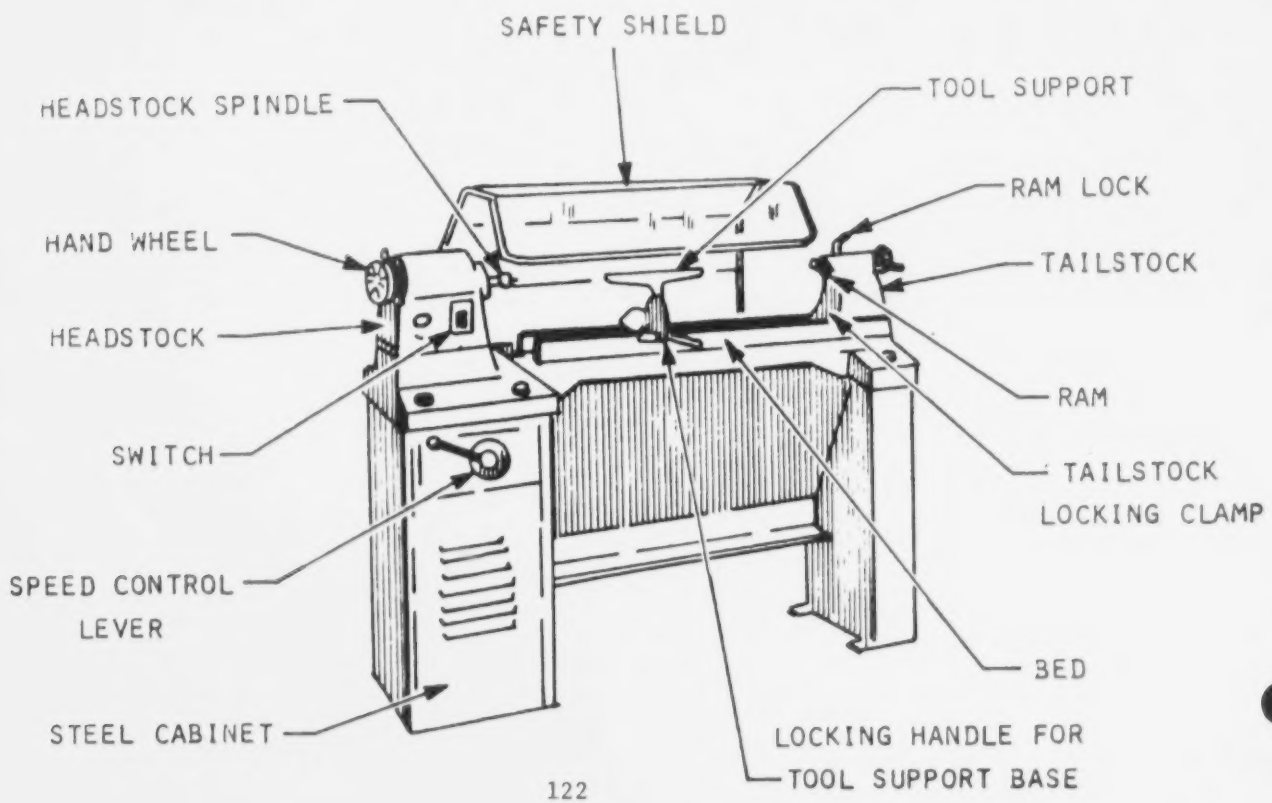
IDENTIFY PARTS



# Wood Lathe

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. CAREFULLY EXAMINE ALL WOOD FOR CHECKS, KNOTS, OR OTHER DEFECTS BEFORE PUTTING ON THE LATHE.
2. WORK MUST BE BALANCED AND SECURELY HELD BETWEEN CENTERS OR MOUNTED ON A FACE PLATE.
3. ROTATE SPINDLE BY HAND TO CHECK CLEARANCE BEFORE STARTING THE LATHE.
4. TOOL REST MUST BE SET 1/8" FROM THE WORK PIECE AND ADJUSTED TO THE PROPER HEIGHT FOR THE TOOL BEING USED.
5. BE SURE THE LATHE IS RUNNING AT THE PROPER SPEED FOR THE OPERATION.
6. CAUTION MUST BE EXERCISED TO PREVENT TURNING TOOLS FROM CATCHING IN THE STOCKING.
7. USE THE PROPER TOOL FOR THE CUT TO BE MADE.
8. MAKE SURE SAFETY SHIELD IS IN PLACE.
9. REMOVE TOOL REST AND BASE BEFORE SANDING OR POLISHING.
10. USE A BRUSH TO CLEAN OFF LATHE WHEN FINISHED.

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NAME _____

DATE _____ GRADE _____

# Wood Lathe

SAFETY QUIZ

CIRCLE ONE

1. A FACE SHIELD IS WORN TO PREVENT WOOD CHIPS FROM GETTING IN YOUR EYES, MOUTH, AND NOSE. T F

2. WHEN USING A CALIPER TO CHECK DIAMETER, IT IS NECESSARY THAT THE LATHE BE AT A DEAD STOP. T F

3. DURING SANDING OPERATIONS, IT IS NECESSARY TO REMOVE THE TOOL REST TO PREVENT ACCIDENTS. T F

4. DULL TOOLS MAY BE USED FOR A ROUGHING OPERATION. T F

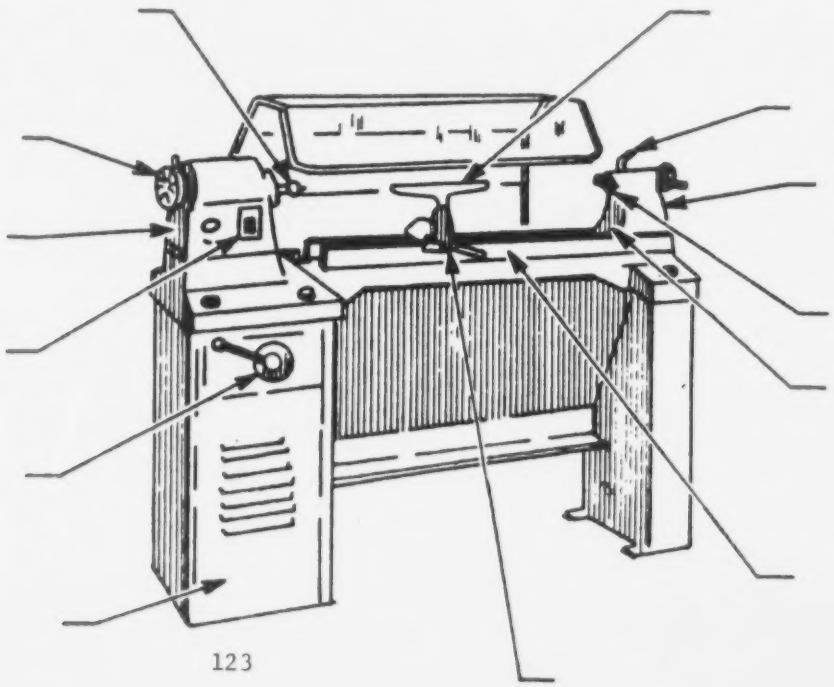
5. YOU ARE ALLOWED TO OPERATE THE LATHE WITHOUT THE SAFETY SHIELD LOWERED. T F

6. LONG SLEEVES MAY BE WORN WHILE OPERATING THE LATHE. T F

7. CHECK SET-UP AT THE FASTEST SPEED AND THEN LOWER IT FOR OPERATION. T F

8. A SPACE OF 1" IS SAFE BETWEEN THE TOOL REST AND THE WORK PIECE. T F

IDENTIFY PARTS



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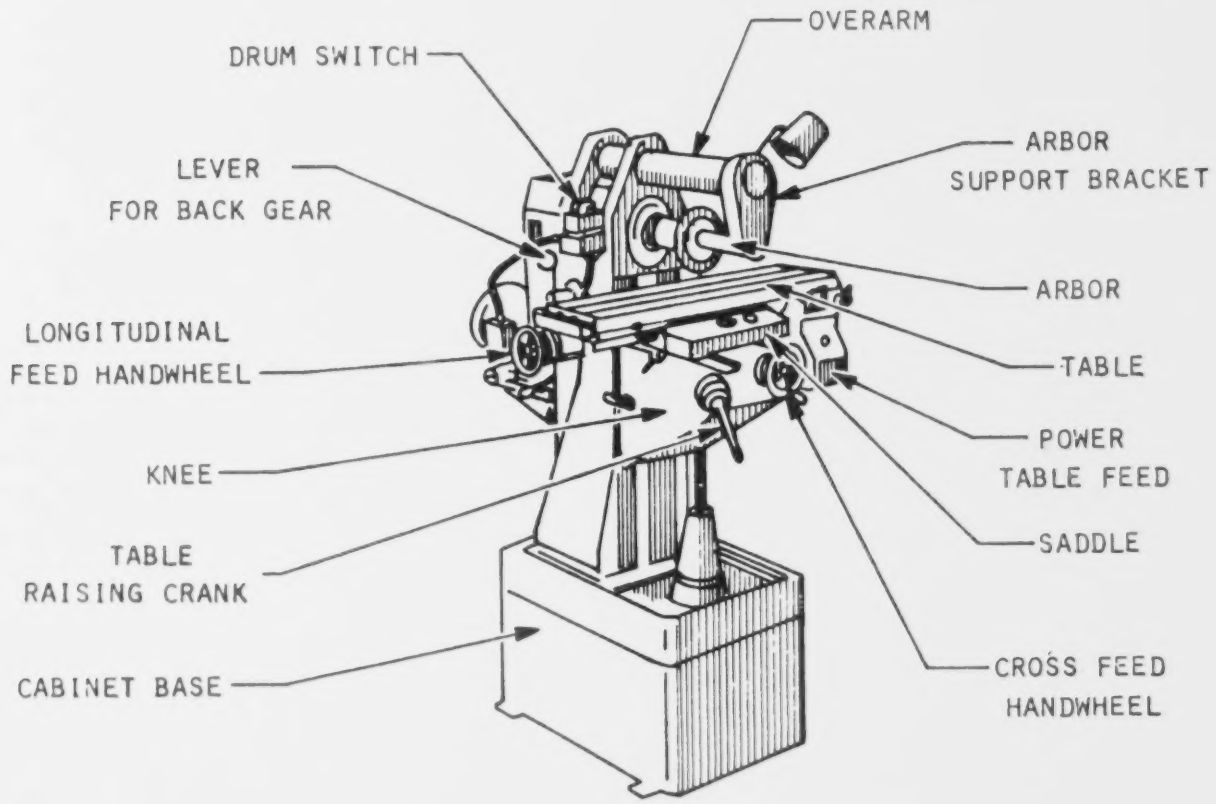
# Horizontal Milling Machine

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. MAKE ALL MEASUREMENTS AND ADJUSTMENTS WITH THE POWER OFF.
2. BE SURE THE HOLDING DEVICE IS MOUNTED SOLIDLY TO THE TABLE, AND THE WORK HELD FIRMLY.
3. NEVER REACH OVER OR NEAR THE ROTATING CENTER.
4. CUTTERS SHOULD NOT BE HANDLED WITH BARE HANDS.
5. NEVER CLEAR CHIPS AWAY WHILE THE MACHINE IS IN OPERATION. USE A SMALL BRUSH TO REMOVE CHIPS.
6. REMAIN WITH THE MACHINE FOR THE DURATION OF THE CUT.
7. KEEP THE FLOOR AROUND THE MACHINE CLEAR OF CHIPS, AND WIPE UP SPILLED CUTTING FLUID IMMEDIATELY.
8. PUT ALL OILY RAGS USED TO WIPE DOWN THE MACHINE IN A METAL CONTAINER THAT CAN BE CLOSED TIGHTLY.



NAME _____

DATE _____ GRADE _____

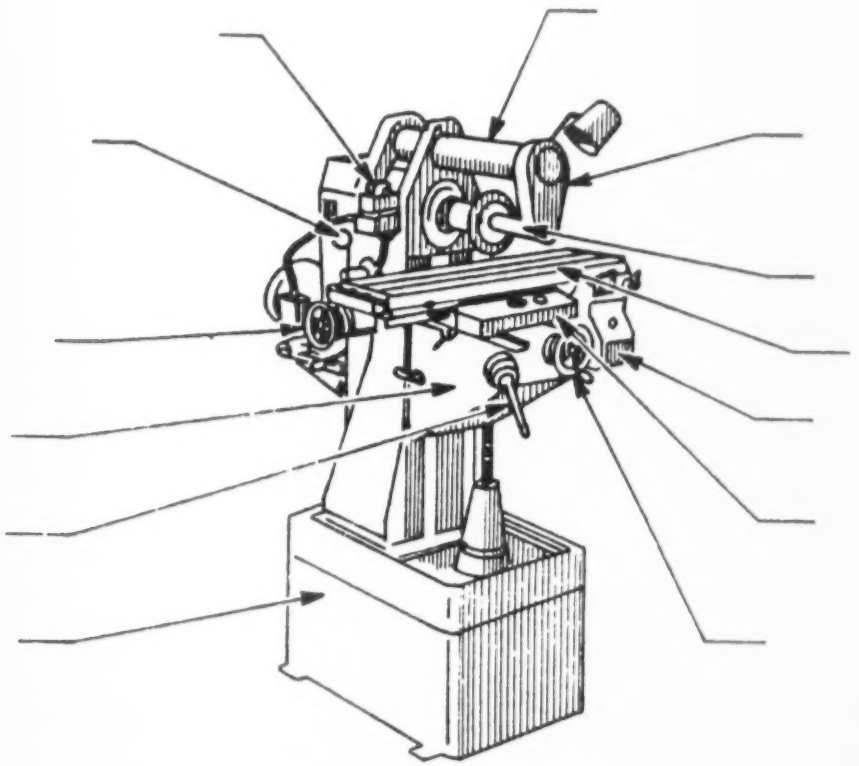
# Horizontal Milling Machine

SAFETY QUIZ

CIRCLE ONE

1. SMALL CHIPS CAN BE SAFELY WIPED AWAY BY HAND IF THE MACHINE IS STOPPED. T F
2. WORK SHOULD BE HELD FIRMLY IN YOUR HANDS. T F
3. ONCE YOU HAVE SET UP THE WORK AND STARTED THE MACHINE, YOU CAN LEAVE THE MACHINE. T F
4. SINCE THEY ARE VERY SHARP, CUTTERS SHOULD BE HANDLED CAREFULLY. T F
5. ALL ADJUSTMENTS MUST BE MADE OR CHECKED WITH THE POWER OFF. T F
6. ALWAYS LEAVE OILY RAGS USED TO WIPE DOWN THE MACHINE HANGING NEARBY. T F

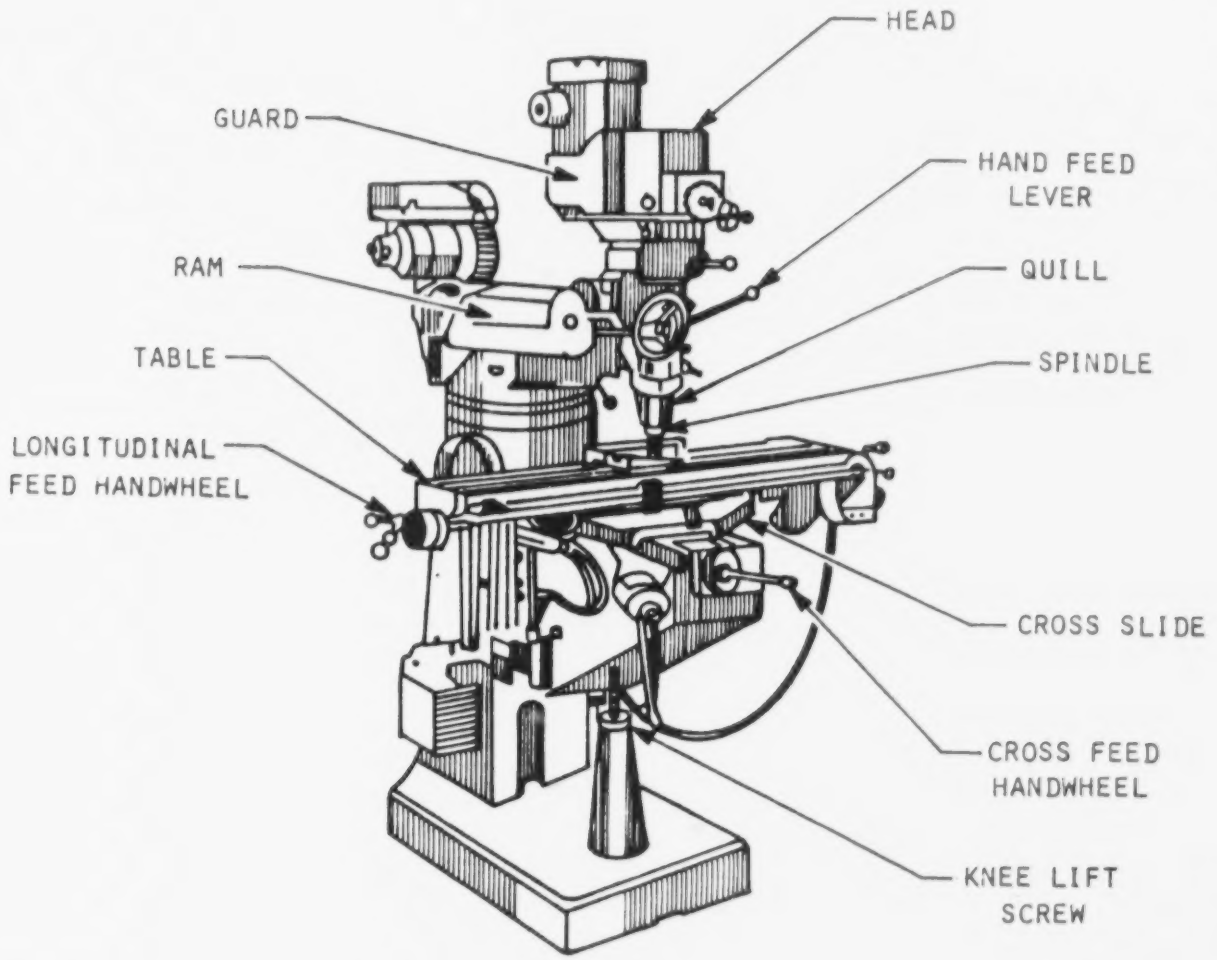
IDENTIFY PARTS



# Vertical Milling Machine

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. ALL ADJUSTMENTS MUST BE MADE WITH THE POWER OFF.
2. STOCK SHOULD BE SECURED IN A VISE, CLAMP OR CHUCK.
3. KEEP HANDS A MINIMUM OF 4" FROM CUTTERS.
4. DO NOT LEAVE THE MACHINE WHILE IT IS IN OPERATION.
5. NEVER REACH OVER OR NEAR THE ROTATING CUTTER.
6. ONCE A CUTTING PASS IS MADE, DO NOT BACK OUT OR RETURN TO THE STARTING POSITION.
7. REMOVE CHIPS WITH A BRUSH AFTER THE MACHINE IS TURNED OFF.



NAME _____

DATE _____ GRADE _____

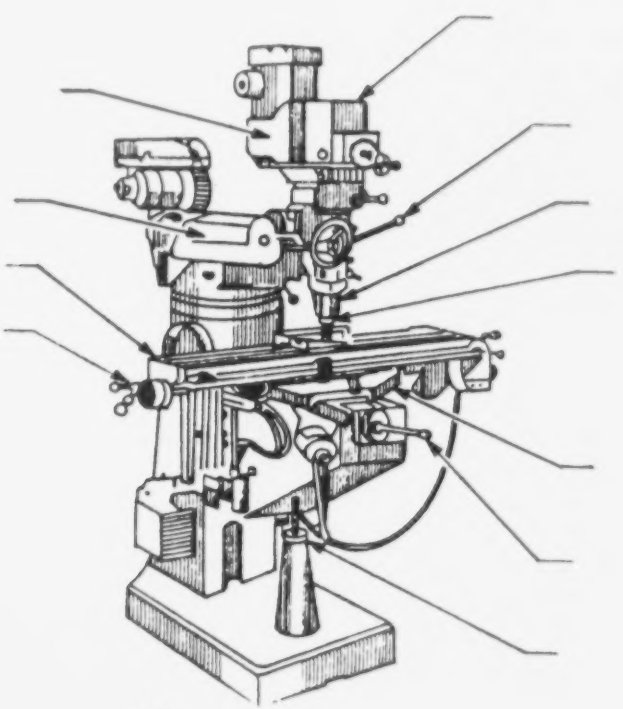
# Vertical Milling Machine

SAFETY QUIZ

CIRCLE ONE

1. FLOOR AREA AROUND THE MACHINE SHOULD BE KEPT CLEAR. T F
2. ONCE THE MACHINE IS ON AUTOMATIC CUTTING, YOU MAY LEAVE THE MACHINE. T F
3. CUTTERS SHOULD BE HANDLED CAREFULLY TO PREVENT DULLING. T F
4. FINGERS SHOULD NOT TOUCH THE CUTTER. T F
5. IF A BRUSH IS USED, CHIPS MAY BE REMOVED WHILE THE MACHINE IS RUNNING. T F
6. ALL WORK MUST BE SECURED TO THE TABLE BEFORE STARTING THE CUT. T F
7. CLEARANCE IS NEEDED TO BACK OUT OF A CUT. T F
8. ADJUSTMENTS ARE MADE WITH THE POWER OFF. T F

IDENTIFY PARTS



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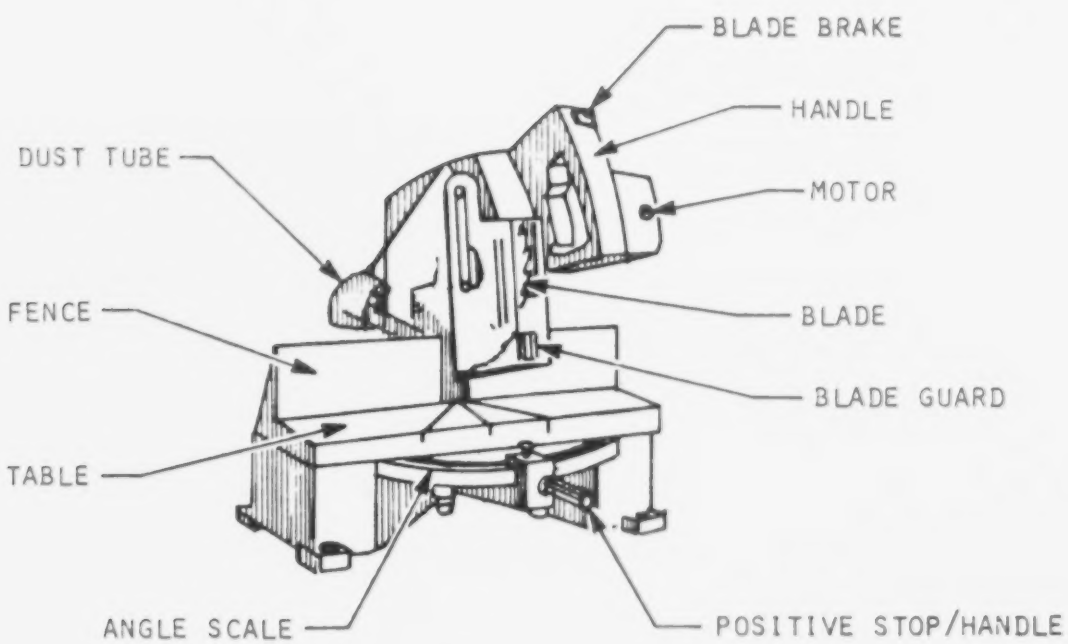
# Motorized Miter Box

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. DISCONNECT POWER BEFORE MAKING ANGLE ADJUSTMENTS OR CHANGING BLADES.
2. ALWAYS HOLD THE WORK FIRMLY AGAINST THE FENCE AND TABLE.
3. ALLOW THE MOTOR TO REACH FULL SPEED BEFORE STARTING A CUT.
4. KEEP FINGERS OUTSIDE OF BLADE GUARDS.
5. REMOVE SCRAP STOCK FROM TABLE WHEN MAKING MULTIPLE CUTS.
6. USE THE BRAKE TO STOP THE BLADE.



NAME _____

DATE _____ GRADE _____

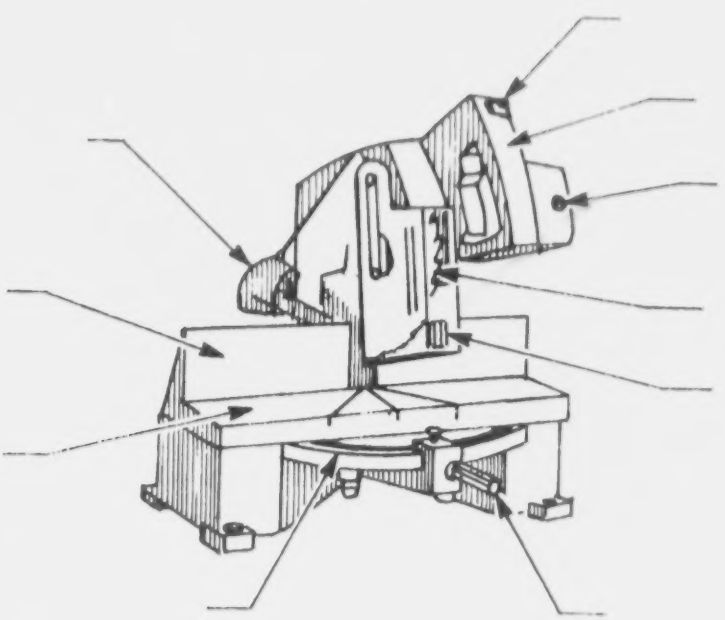
# Motorized Miter Box

SAFETY QUIZ

CIRCLE ONE

1. ALWAYS HOLD THE WORK FIRMLY AGAINST THE FENCE AND TABLE. T F
2. THE MACHINE SHOULD BE STOPPED BY PUSHING A PIECE OF SCRAP AGAINST THE SIDE OF THE BLADE. T F
3. THE GUARD SECTIONS CAN EASILY BE CHECKED FOR PROPER OPERATION BEFORE STARTING TO USE THE MACHINE. T F
4. THE TRIGGER SWITCH AND THE BRAKE BUTTON CAN BE USED TOGETHER TO GAIN BETTER CONTROL. T F
5. FINGERS SHOULD BE KEPT OUTSIDE OF THE BLADE GUARDS. T F

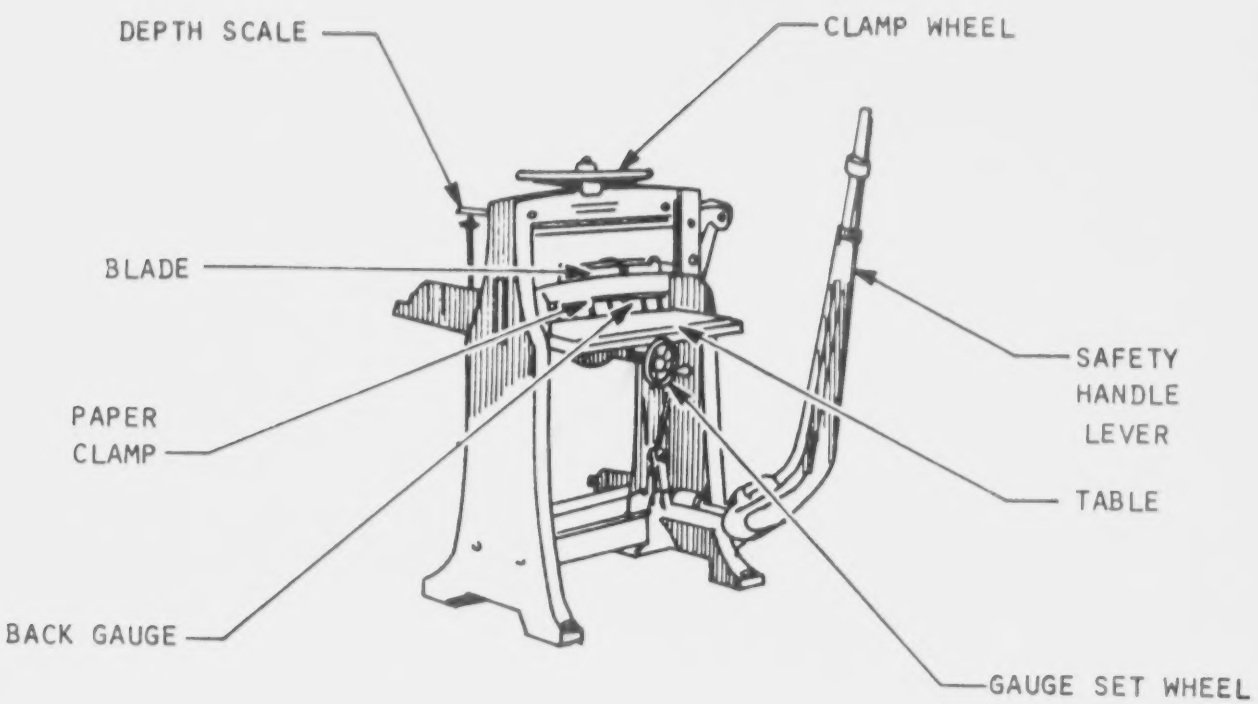
IDENTIFY PARTS



# Paper Cutter

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. ONLY ONE PERSON SHOULD OPERATE THE CUTTER.
2. NEVER TIE DOWN THE SAFETY CONTROL LEVER.
3. CUT PAPER ONLY.
4. KEEP PAPER CUTTER FREE OF STOCK, TOOLS, AND PAPER SCRAPS.
5. BOTH HANDS MUST BE KEPT ON THE CONTROLS DURING THE COMPLETE CLAMPING AND CUTTING OPERATION.
6. WHEN CUTTING PAPER OF DIFFERENT LENGTHS, PUT THE SMALLEST AT THE TOP.
7. BE SURE ALL PAPER IS LAID FLAT BEFORE CLAMPING.
8. FLOOR AREA AROUND THE MACHINE AND CONTROLS MUST BE KEPT CLEAR OF TRIMMINGS.



NAME _____

DATE _____ GRADE _____

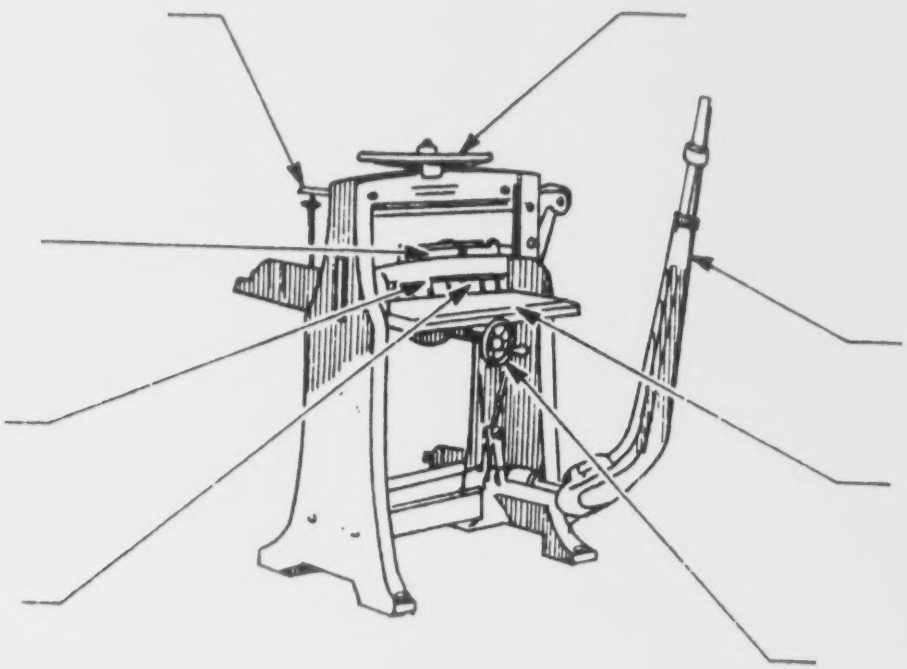
# Paper Cutter

SAFETY QUIZ

CIRCLE ONE

1. ALL PAPER SHOULD BE PICKED UP AFTER USING THE CUTTER. T F
2. THE PAPER CUTTER MAY ALSO BE USED TO CUT THIN SHEET METALS. T F
3. OBTAIN HELP WHEN CUTTING THICK STOCK. T F
4. STOPS OR GAGES SHOULD BE ADJUSTED ONLY WHEN THE HANDLE IS IN THE UP POSITION. T F
5. HANDS SHOULD ALWAYS BE KEPT CLEAR OF THE CLAMP AND THE CUTTER. T F
6. ALWAYS STACK THE STOCK WITH THE SMALLER SHEETS ON TOP. T F

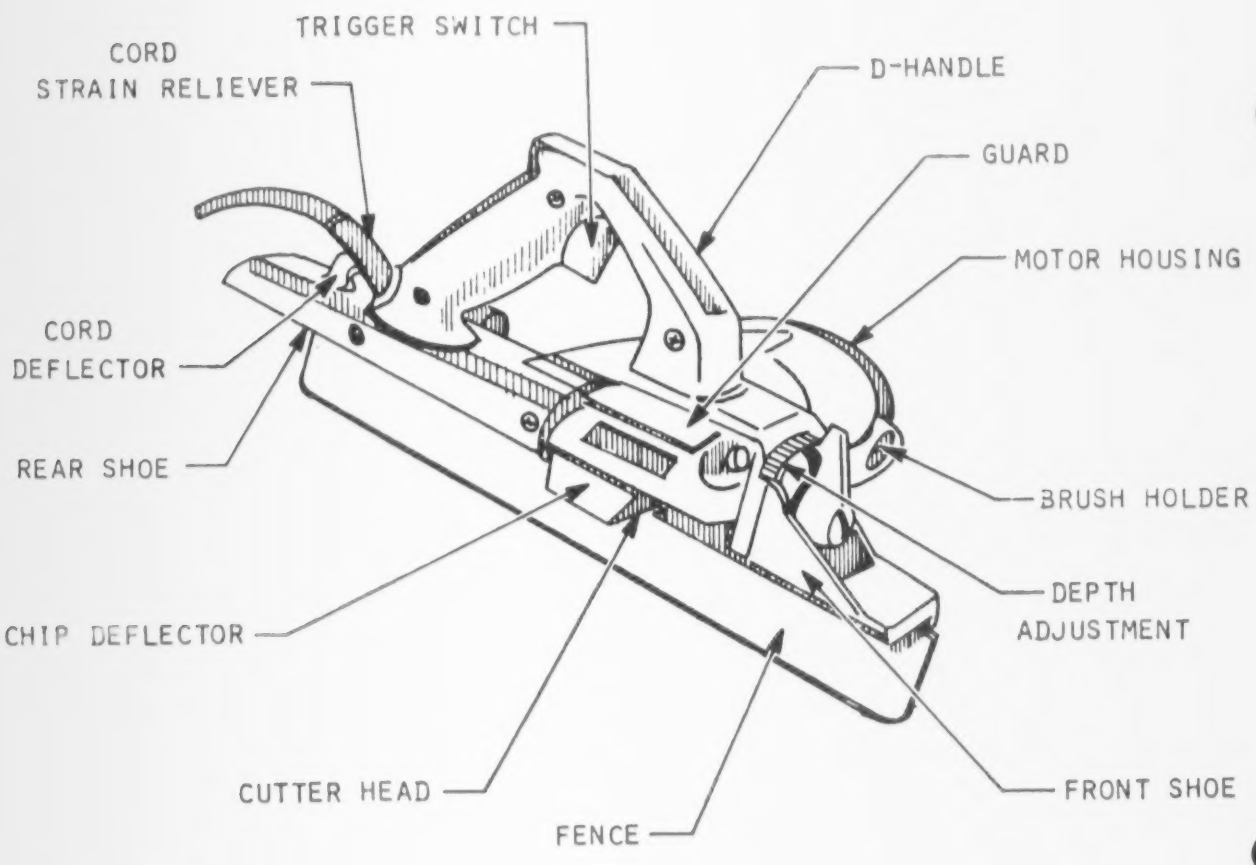
IDENTIFY PARTS



# Portable Plane

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BEFORE CONNECTING TO THE POWER SOURCE, MAKE SURE THE SWITCH IS IN THE "OFF" POSITION.
2. MAKE ALL ADJUSTMENTS WITH THE PLANE DISCONNECTED FROM THE POWER SOURCE.
3. BE SURE ALL STOCK IS CLAMPED SECURELY.
4. KEEP BOTH HANDS ON THE MACHINE, AWAY FROM THE CUTTER HEAD.
5. PLACE THE FRONT SHOE ON THE WORK PIECE, START MOTOR, THEN MOVE PLANE OVER THE STOCK KEEPING PRESSURE AND SPEED CONSTANT.
6. KEEP FENCE AND NEAR SHOE TIGHTLY AGAINST THE STOCK UNTIL THE CUTTER HAS CLEARED THE STOCK.



NAME _____

DATE _____ GRADE _____

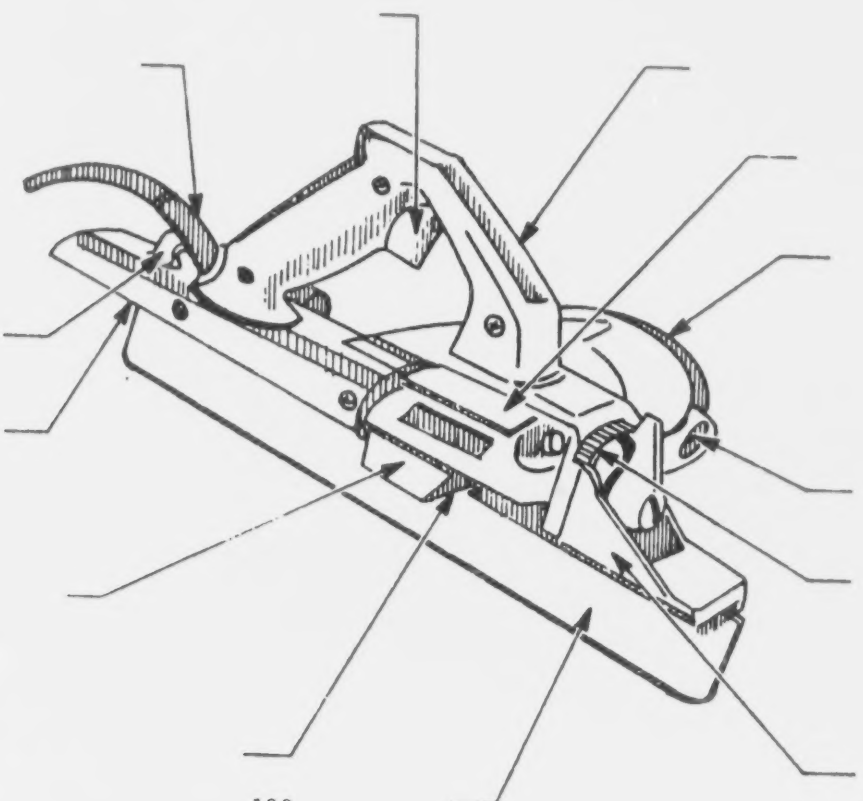
# Portable Plane

SAFETY QUIZ

CIRCLE ONE

1. THE PLANE SHOULD BE ADJUSTED BEFORE TURNING ON. T F
2. SINCE THE CUTTER WILL NOT TOUCH, IT IS ALL RIGHT TO SET THE PLANE ON THE BENCH WHILE STILL RUNNING. T F
3. THE PLANE WILL CUT DEEPER THE MORE PRESSURE IS APPLIED. T F
4. CLAMP ALL STOCK SECURELY. T F
5. THE PLANE SHOULD BE KEPT FIRMLY AGAINST THE WORK PIECE UNTIL THE CUT IS COMPLETED. T F

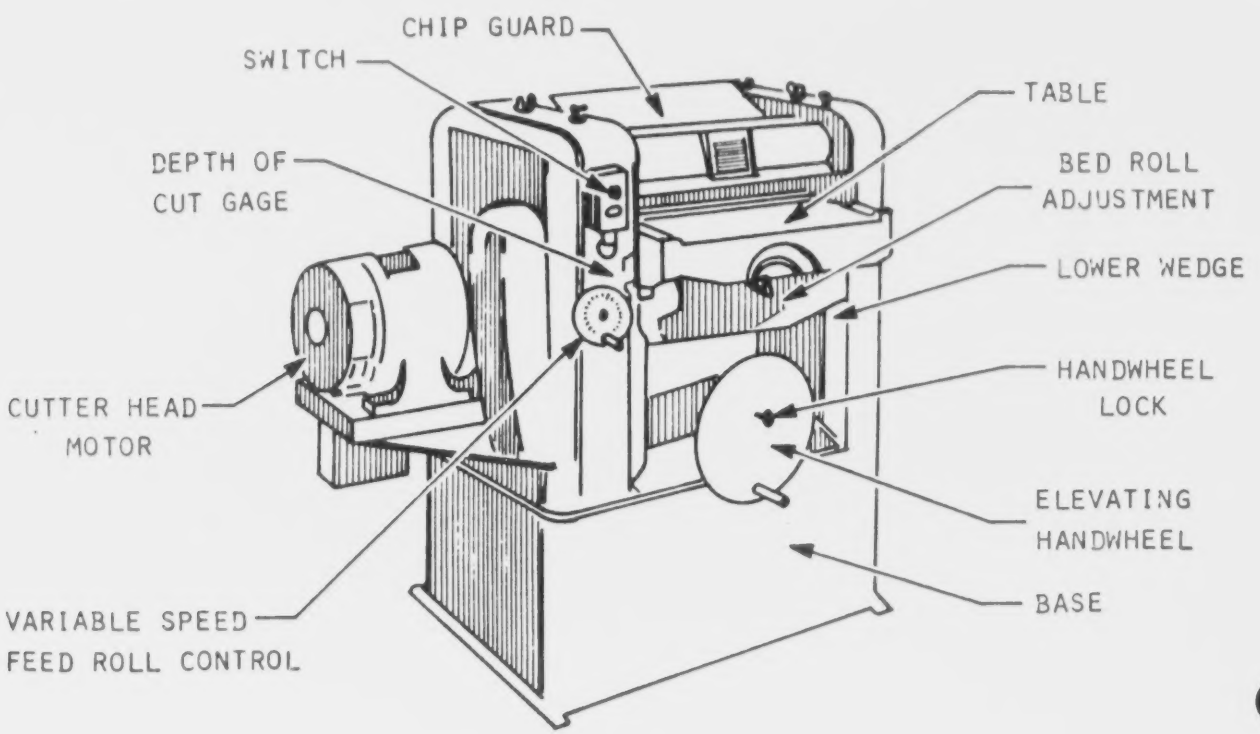
IDENTIFY PARTS



# Planer-Surfacer

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. CHECK ALL MATERIAL FOR LOOSE KNOTS, NAILS, AND OTHER FOREIGN OBJECTS.
2. KEEP THE FLOOR AROUND THE MACHINE CLEAN AND FREE OF SCRAPS.
3. DO NOT FORCE STOCK THROUGH THE PLANER. KEEP HANDS OFF THE MATERIAL AND LET THE POWER FEED OPERATE.
4. NEVER PLANE WARPED OR TWISTED BOARDS UNTIL THEY HAVE BEEN TRUED ON ANOTHER MACHINE.
5. SELECT THE PROPER DEPTH OF CUT AND THE RATE OF SPEED DEPENDING ON THE STOCK BEING PLANED.
6. THIN STOCK SHOULD BE PROPERLY SUPPORTED BY A JIG OR BACK UP BOARD.
7. NEVER LOOK DIRECTLY INTO THE THROAT OF A PLANER AT TABLE LEVEL WHILE IT IS RUNNING.
8. STOCK MUST BE LONGER THAN THE DIFFERENCE BETWEEN FEED ROLLS.
9. REMOVE CHIPS WHEN THE POWER IS TURNED OFF. KEEP HANDS AWAY FROM CHIP GUARD AND THE POINT OF OPERATION.
10. DO NOT STAND DIRECTLY IN FRONT OF THE MACHINE IN LINE OF POSSIBLE KICKBACK.



NAME _____

DATE _____ GRADE _____

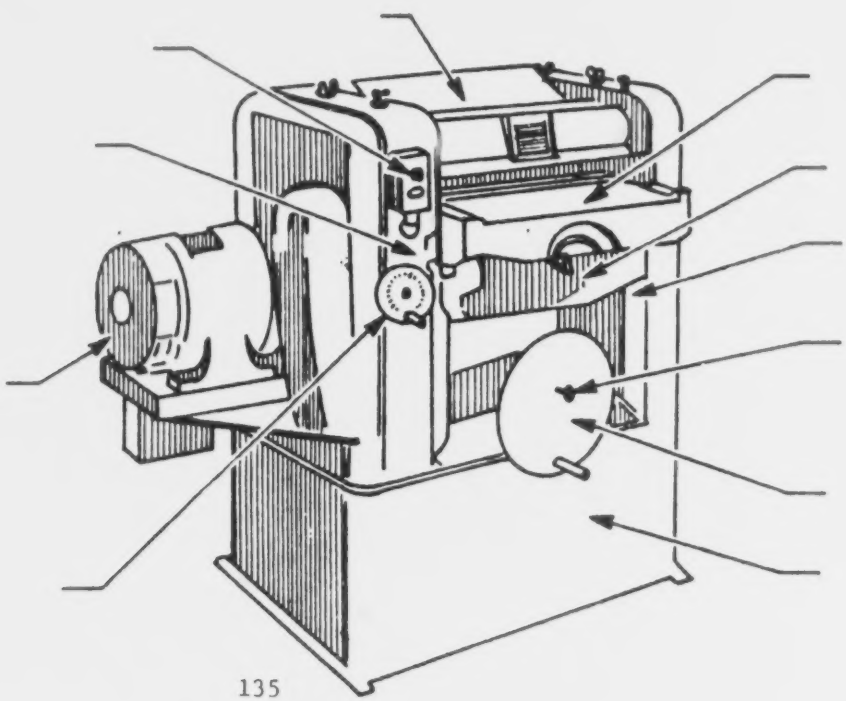
# Planer-Surfacer

SAFETY QUIZ

CIRCLE ONE

1. ALL STOCK SHOULD BE CHECKED FOR LOOSE KNOTS, NAILS, AND OTHER FOREIGN OBJECTS. T F
2. A "BACKING BOARD" SHOULD BE USED WHENEVER SURFACING WOOD. T F
3. CHIPS SHOULD ONLY BE REMOVED WHILE THE POWER IS OFF. T F
4. TO CHECK ON THE ACCURACY OF THE CUT, LOOK INTO THE THROAT OF THE MACHINE. T F
5. NEVER FORCE THE MATERIAL INTO THE MACHINE. T F
6. LOOSE KNOTS SHOULD BE REMOVED. T F
7. THE MATERIAL IS FED INTO THE SURFACER CROSS GRAIN. T F
8. IF THE MATERIAL STOPS FEEDING INTO THE SURFACER, TURN THE MACHINE OFF. T F

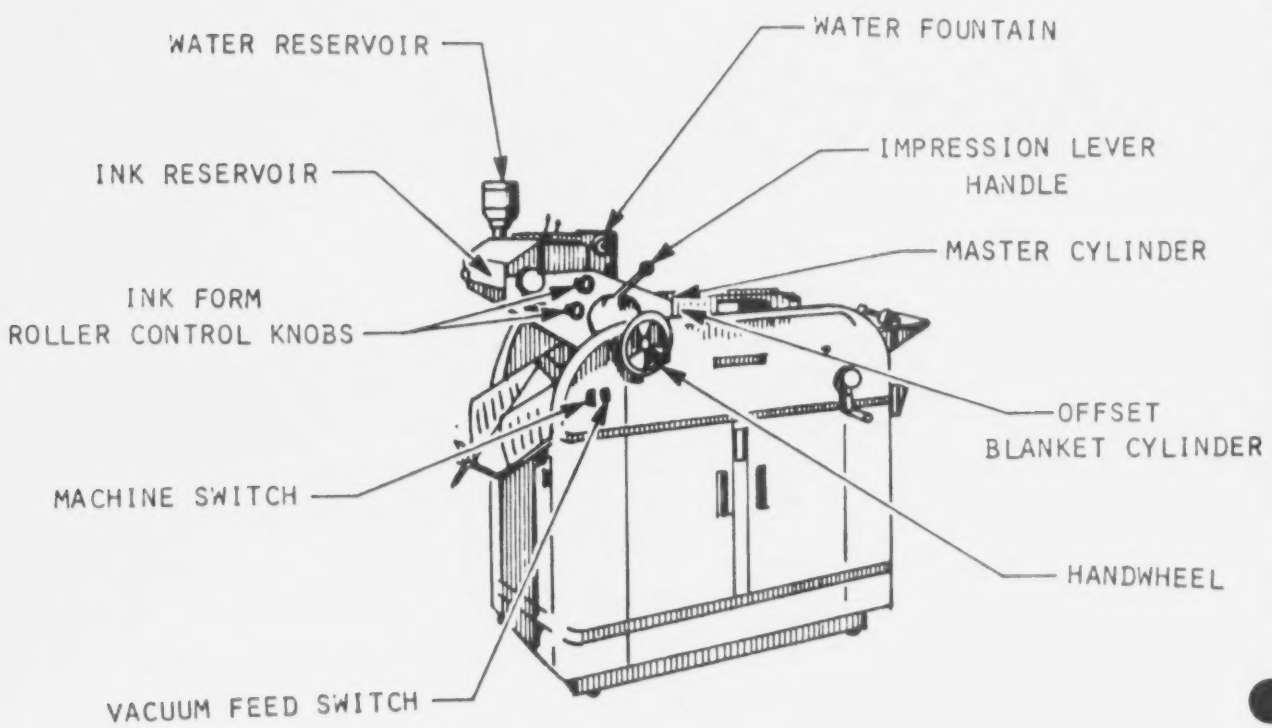
IDENTIFY PARTS



# Offset Printing Press

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. DO NOT OIL OR CLEAN PRESS WHILE IN OPERATION.
2. INTERNAL ADJUSTMENTS SHOULD NOT BE MADE WHILE THE PRESS IS IN OPERATION.
3. NEVER REACH FOR MISPRINTED OR DROPPED PAPER WHILE THE PRESS IS IN OPERATION.
4. ALWAYS STAND FIRMLY WHILE OPERATING THE PRESS.
5. THE INSTRUCTOR SHOULD DETERMINE THE OPERATING SPEED.
6. NEVER REACH ACROSS THE PRESS WHILE IT IS IN OPERATION.
7. WHEN FINISHED WITH THE PRESS, IT MUST BE CLEANED AND ALL PAPER, EQUIPMENT, AND TOOLS RETURNED TO PROPER STORAGE AREAS.



NAME _____

DATE _____ GRADE _____

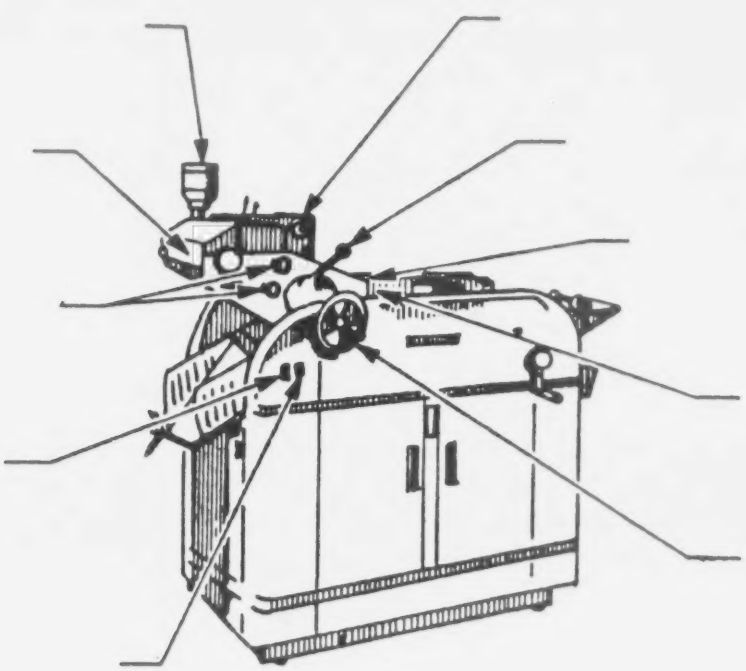
# Offset Printing Press

SAFETY QUIZ

CIRCLE ONE

1. THE PRESS SHOULD ONLY BE OILED WHILE IN OPERATION. T F
2. THE MACHINE MUST BE STOPPED BEFORE MIS-PRINTED OR DROPPED PAPER IS REMOVED FROM THE PRESS. T F
3. FINAL ADJUSTMENTS MAY BE MADE WHILE THE MACHINE IS RUNNING. T F
4. YOU SHOULD BE ALERT TO KEEPING OTHERS AWAY FROM THE PRESS WHILE IT IS IN OPERATION. T F
5. IT IS SAFE TO REACH ACROSS THE PRESS WHEN IT IS OPERATING. T F

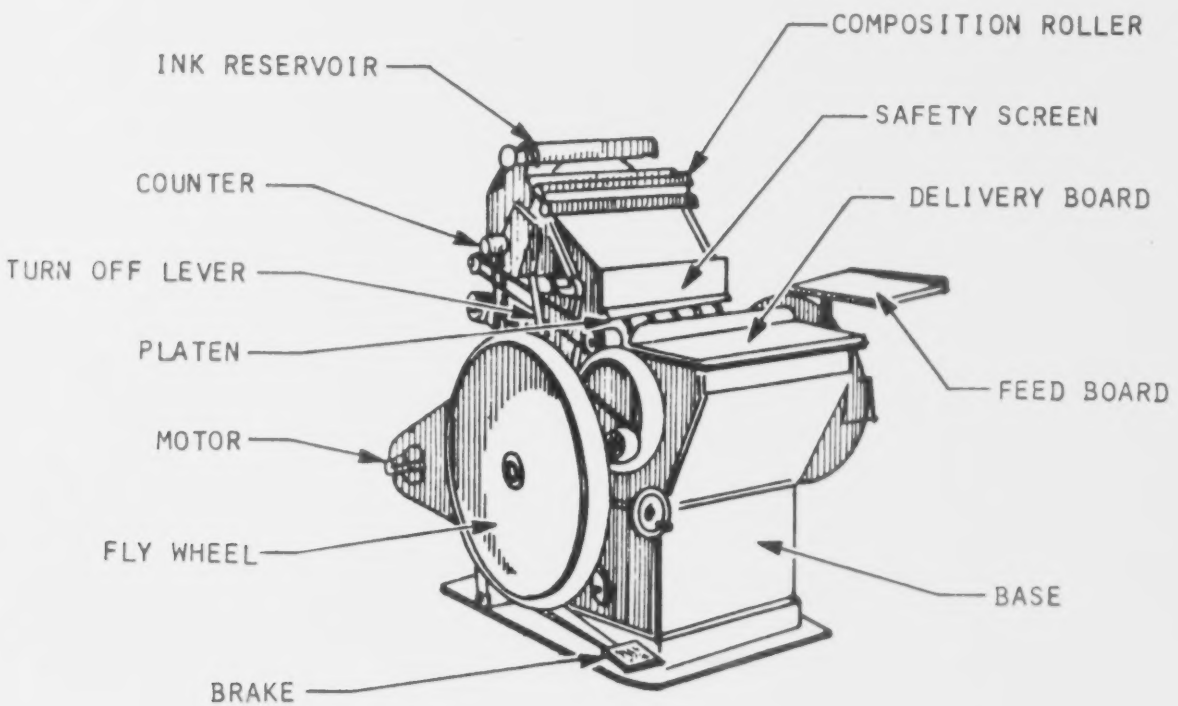
IDENTIFY PARTS



# Platen Printing Press

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. APPLY INK TO THE INK PLATE PRIOR TO STARTING THE PRESS.
2. ALWAYS STAND FIRMLY WHILE OPERATING THE PRESS.
3. OPERATE THE PRESS AT A SPEED THAT MATCHES YOUR ABILITY TO FEED THE PAPER.
4. MAKE SURE THE GRIPPERS ARE NOT IN THE WAY OF THE TYPE FORM.
5. ONLY ONE OPERATOR ON THE PRESS AT A TIME.
6. NEVER REACH INTO THE PRESS TO STRAIGHTEN THE PAPER WHILE FEEDING UNTIL THE PRESS HAS OPENED FOR THE NEXT CYCLE.
7. CLEAR ALL MISCELLANEOUS OBJECTS AND PAPER FROM THE FEED AND DELIVERY BOARDS.



NAME _____

DATE _____ GRADE _____

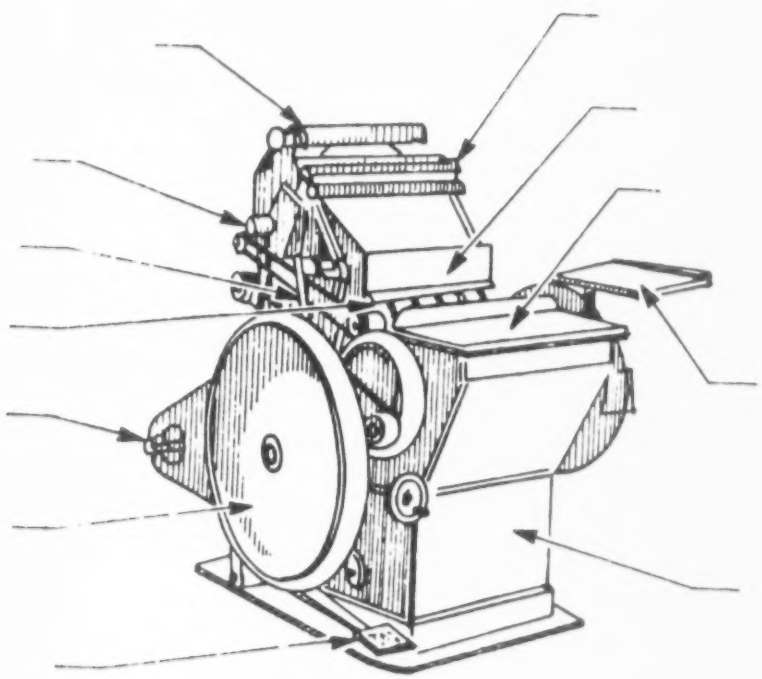
# Platen Printing Press

## SAFETY QUIZ

CIRCLE ONE

1. OPERATE THE PRESS AT A SPEED THAT IS SAFE FOR YOUR ABILITY LEVEL. T F
2. LOOSE CLOTHING OR HAIR MUST BE CONFINED. T F
3. THE POSITION OF THE GRIPPERS IS NOT IMPORTANT. T F
4. THE INK PLATE MAY BE INKED WHILE THE PRESS IS IN OPERATION. T F
5. THREE OR FOUR PEOPLE CAN SUCCESSFULLY OPERATE THE PLATEN PRESS AT THE SAME TIME. T F

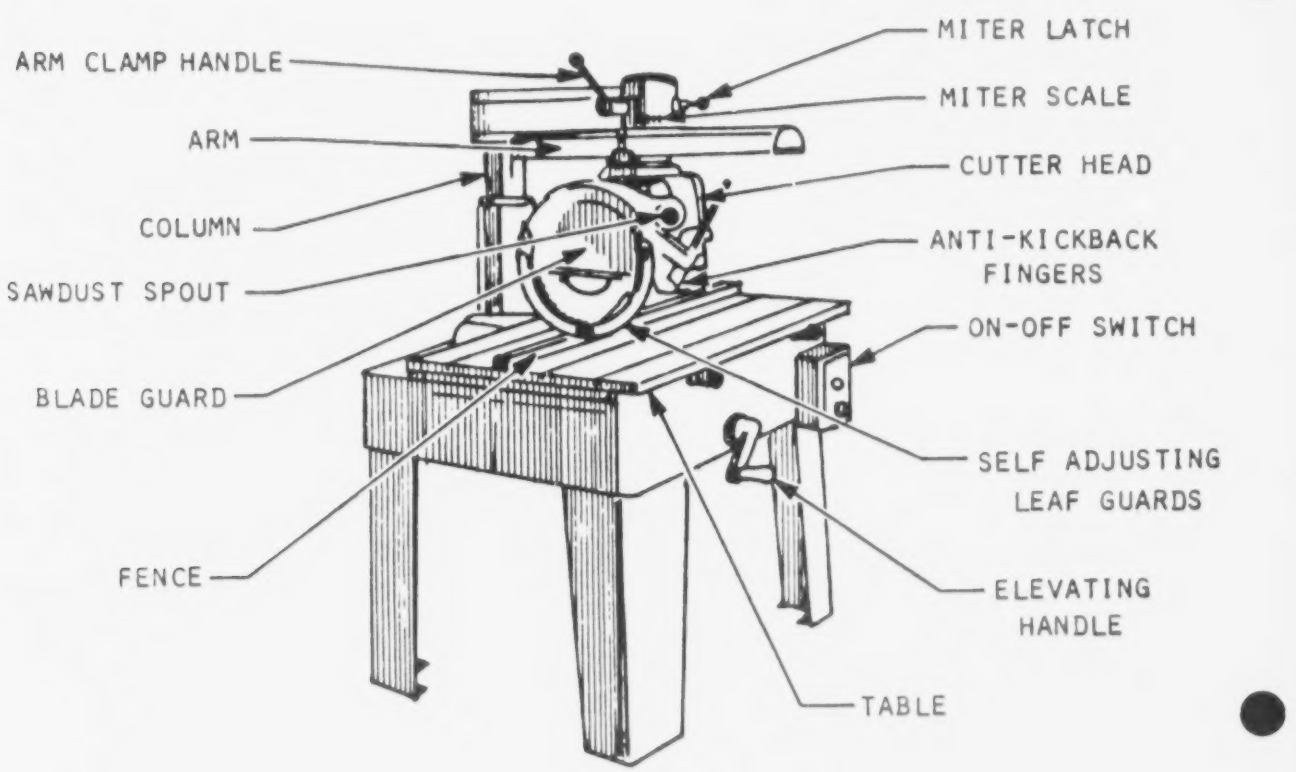
## IDENTIFY PARTS



# Radial Arm Saw

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BE SURE TO PUSH THE SAW BACK AGAINST THE STOP BEFORE TURNING ON THE POWER.
2. ALL STOCK TO BE CROSSCUT MUST BE SET FIRMLY AGAINST THE FENCE.
3. ALWAYS RIP INTO THE BLADE, NEVER IN THE SAME DIRECTION AS THE ROTATION.
4. AVOID WORKING ACROSS THE SAW LINE WITH HANDS OR ARMS.
5. MAKE SURE THAT THE BLADE GUARD AND KICKBACK FINGERS ARE PROPERLY ADJUSTED BEFORE RIPPING.
6. FEED THE SAW BLADE INTO THE STOCK ONLY AS FAST AS THE BLADE WILL CUT SMOOTHLY WITHOUT BINDING.
7. ALWAYS PULL THE BLADE THROUGH THE STOCK AND RETURN THE CUTTER HEAD BEHIND THE FENCE BEFORE REMOVING THE STOCK OR STARTING THE NEXT CUT.
8. MAKE SURE THE BLADE HAS STOPPED BEFORE LEAVING THE MACHINE.



NAME _____

DATE _____ GRADE _____

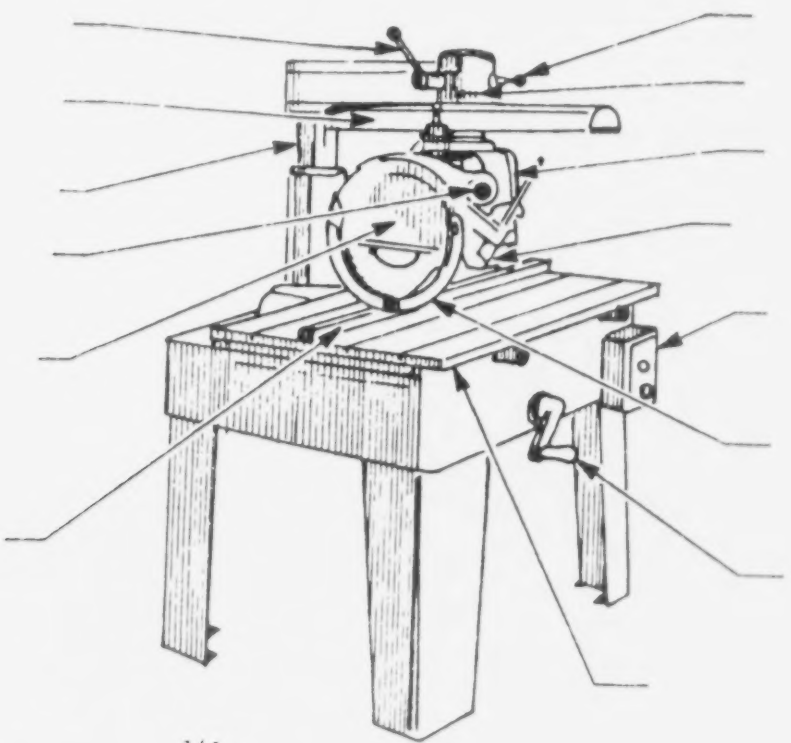
# Radial Arm Saw

SAFETY QUIZ

CIRCLE ONE

1. BE SURE THAT THE BLADE HAS STOPPED BEFORE LEAVING THE MACHINE. T F
2. THE GUARD AND KICKBACK FINGERS MUST BE IN PLACE WHEN RIPPING. T F
3. THE SAW BLADE MAY SAFELY EXTEND BEYOND THE TABLE. T F
4. THE FASTER THE BLADE IS PULLED ACROSS THE STOCK THE BETTER. T F
5. WHEN RIPPING, ONE HAND MUST HOLD THE MATERIAL AND THE OTHER OPERATE THE SAW. T F
6. IN CROSS CUTTING, THE SAW SHOULD BE RETURNED TO THE REAR OF THE ARM UPON THE COMPLETION OF EACH CUT. T F

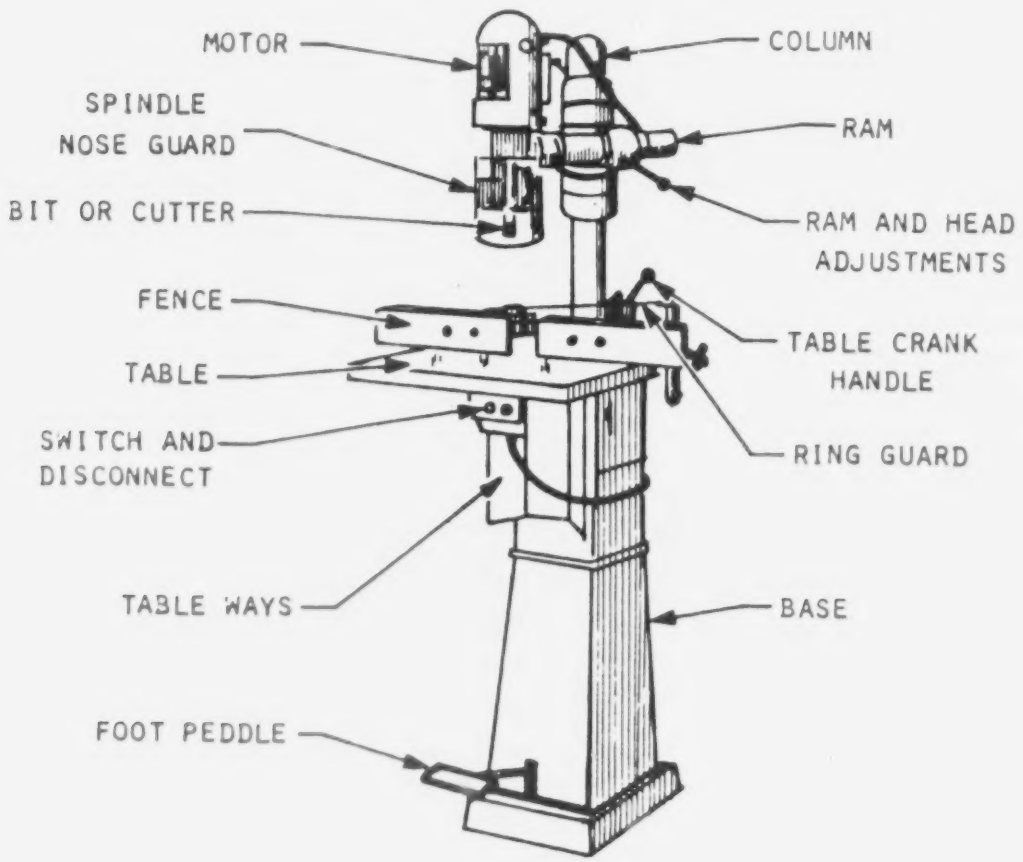
IDENTIFY PARTS



# Overarm Router

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. MAKE ALL ADJUSTMENTS TO THE TABLE, FENCE, OVERARM, AND SPINDLE WITH THE POWER TURNED OFF.
2. DISCONNECT FROM POWER SOURCE WHEN CHANGING CUTTERS OR BITS.
3. CHECK SETUP CAREFULLY BEFORE STARTING OPERATION TO BE SURE CUTTER CLEARS THE TABLE, FENCE, AND ANY FIXTURES.
4. BE SURE GUARD IS IN PLACE BEFORE STARTING CUT.
5. FEED MATERIAL AGAINST THE DIRECTION OF ROTATION WHENEVER POSSIBLE.
6. WHEN PIN ROUTING, MAKE SURE PIN OR TABLE INSERT IS TIGHT AND THE WORK PIECE IS SECURE IN THE JIG.



NAME _____

DATE _____ GRADE _____

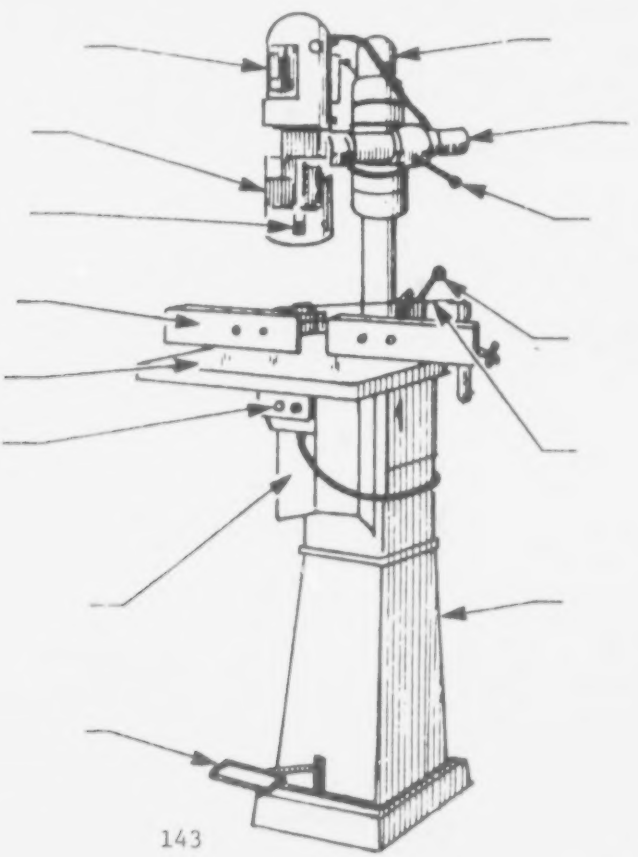
# Overarm Router

## SAFETY QUIZ

CIRCLE ONE

1. WHEN SHAPING OR ROUTING, A JOGGING MOTION WILL GIVE A SMOOTHER CUT. T F
2. SPECIAL OR CUSTOM JIGS OR FIXTURES ARE NECESSARY FOR SOME OPERATIONS. T F
3. THE MACHINE MUST BE DISCONNECTED FROM THE POWER SOURCE WHEN CHANGING BITS. T F
4. THE SPEED OF THIS MACHINE IS ABOUT 5 THOUSAND RPM. T F
5. BOTH HANDS SHOULD BE USED TO MOVE OR CONTROL THE WORK PIECE. T F

## IDENTIFY PARTS



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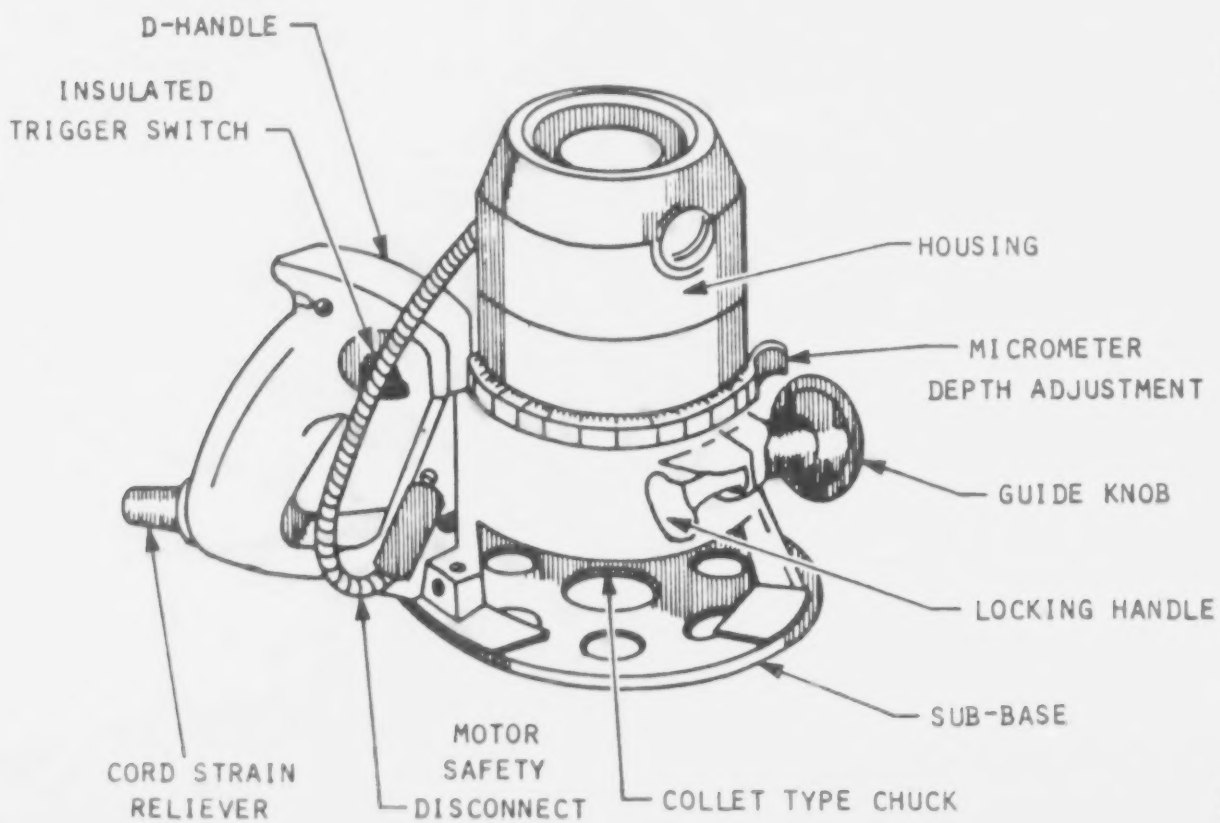
# Portable Router

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BE SURE THE POWER SWITCH IS "OFF" BEFORE PLUGGING IN THE CORD.
2. MAKE SURE THE COLLET CHUCK IS TIGHT AND THE BIT SECURE.
3. SECURE THE STOCK TIGHTLY AND KEEP THE AREA FREE OF OBSTRUCTIONS.
4. USE BOTH HANDS TO HOLD THE ROUTER.
5. DO NOT FORCE OR JAM INTO THE STOCK, CUTTING PRESSURE SHOULD BE KEPT CONSTANT.
6. MAKE A TRIAL CUT IN A PIECE OF SIMILAR SCRAP STOCK.
7. DISCONNECT FROM POWER SOURCE WHEN CHANGING BITS, MAKING ADJUSTMENTS, OR WHEN ROUTER IS NOT IN USE.
8. ALLOW THE BIT TO STOP ROTATING BEFORE PLACING ON THE WORK TABLE.
9. ON DEEP CUTS, TAKE SMALL CUTS AT A TIME.



NAME _____

DATE _____ GRADE _____

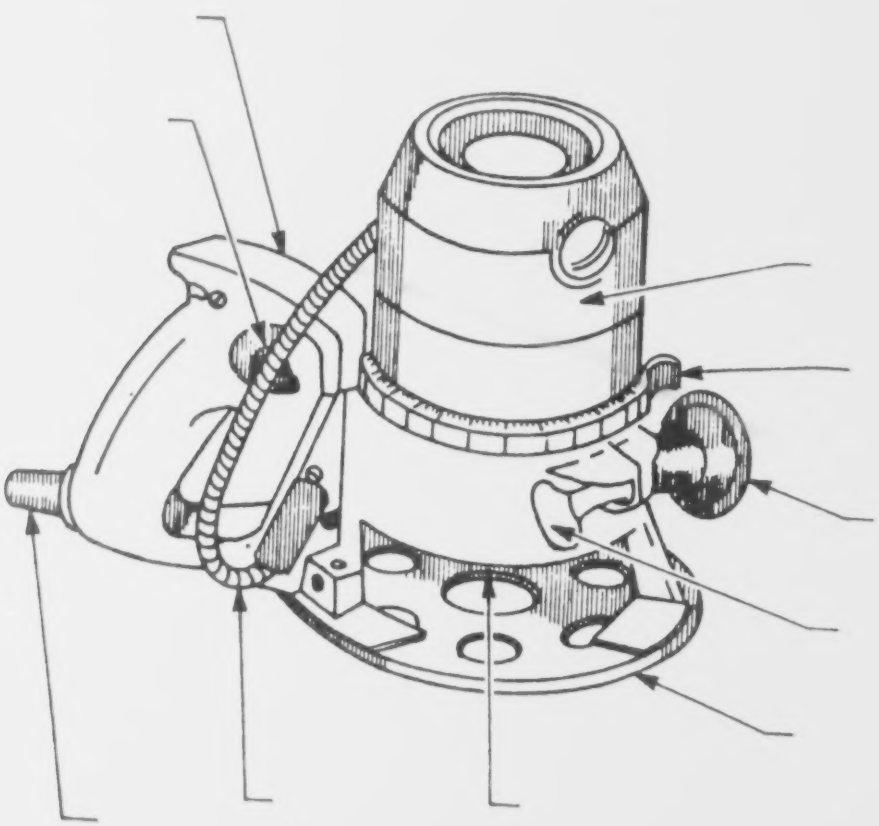
# Portable Router

SAFETY QUIZ

CIRCLE ONE

1. THE COLLET SHOULD BE LOOSE SO THE BIT CAN TURN. T F
2. ADJUSTMENTS CAN BE MADE WHILE THE PLUG IS IN. T F
3. THE ROUTER CAN BE OPERATED WITH ONE HAND. T F
4. CLAMP ALL STOCK SECURELY. T F
5. IT'S A GOOD IDEA TO MAKE A TRIAL CUT IN SCRAPWOOD. T F
6. TO KEEP THE BIT COOL, CUT RAPIDLY. T F

IDENTIFY PARTS



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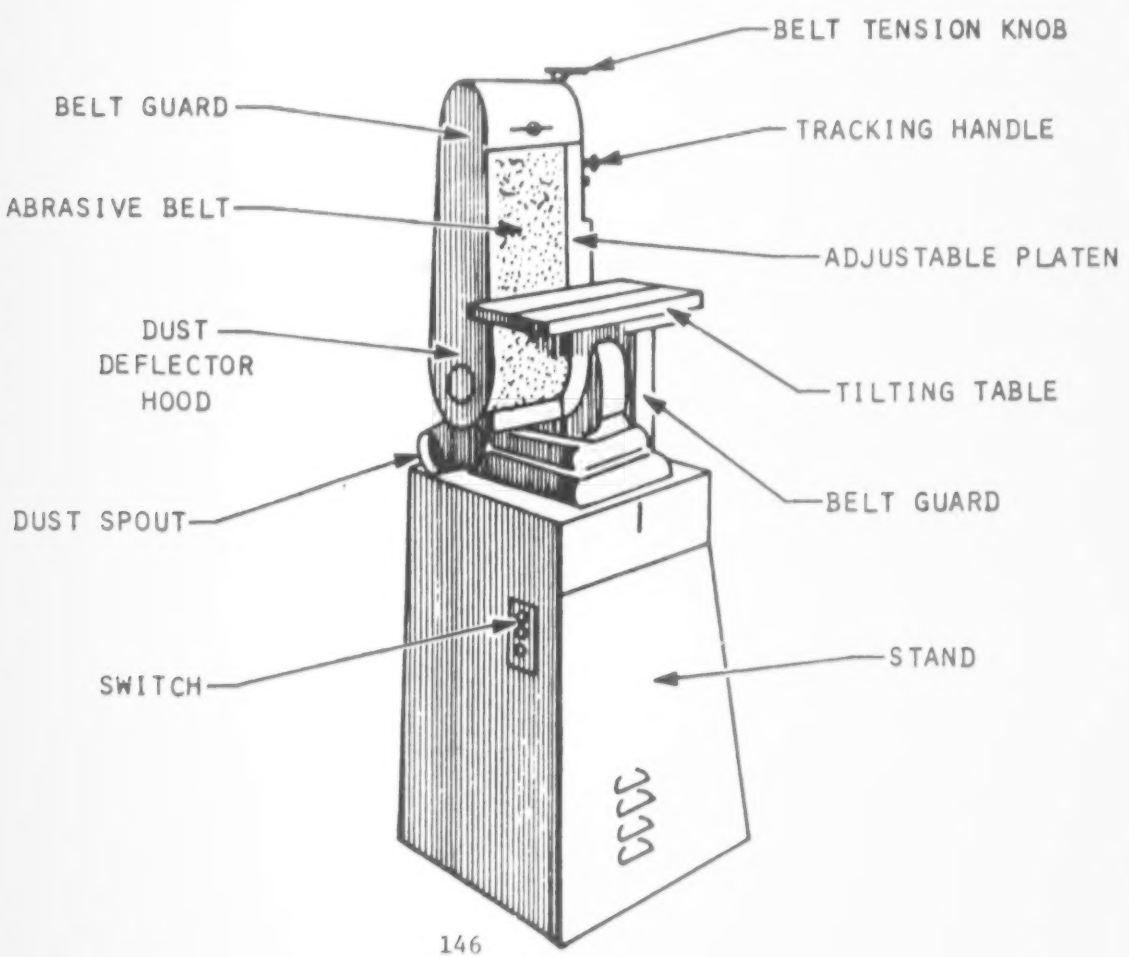
# Belt Finishing Sander

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. MAKE SURE THERE IS ADEQUATE, STRONG TENSION ON THE BELT AND THAT IT IS NOT TORN.
2. MAKE ALL ADJUSTMENTS EXCEPT FINAL BELT TRACKING WITH THE POWER OFF.
3. WHEN CHANGING BELTS, MAKE SURE THE NEW BELT RUNS AS ARROWS INDICATE.
4. ADJUST TABLE TO WITHIN 1/16" OF THE ABRASIVE BELT.
5. SAND ON THE DOWN STROKE OF THE BELT SANDER.
6. MACHINE SAND ONLY OBJECTS LARGE ENOUGH TO HOLD SAFELY AGAINST THE BELT.
7. MOVE STOCK EVENLY AND STEADILY OVER ABRASIVE SURFACE OF THE SANDER.
8. KEEP HANDS CLEAR OF THE ABRASIVE BELT WHILE OPERATING AND KEEP MATERIAL FLAT ON THE TABLE.



NAME _____

DATE _____ GRADE _____

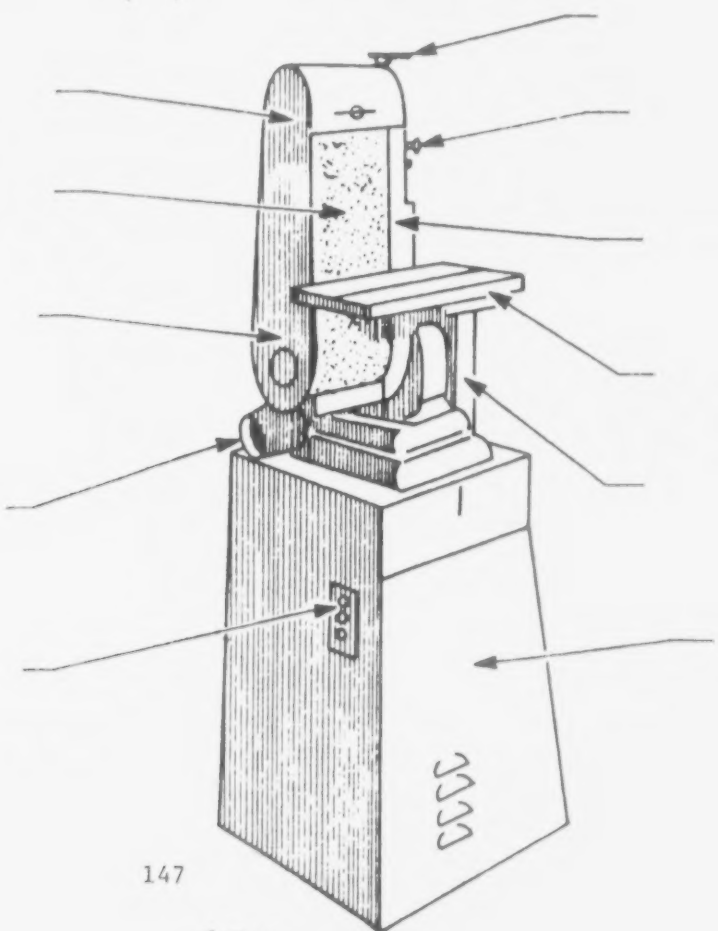
# Belt Finishing Sander

SAFETY QUIZ

CIRCLE ONE

1. THE BELT SHOULD BE MOUNTED ACCORDING TO THE ARROW ON THE INSIDE OF THE BELT. T F
2. THE MACHINE MUST BE OPERATED WITH ALL GUARDS IN PLACE. T F
3. BELTS CONTAINING SMALL RIPS ARE PERMISSABLE TO USE. T F
4. THE BELT TRACK MUST BE ADJUSTED WITH THE POWER ON. T F
5. THE TABLE MUST BE 1/16" FROM THE BELT. T F
6. THE WORK MUST BE KEPT IN MOVEMENT WHILE SANDING. T F

IDENTIFY PARTS



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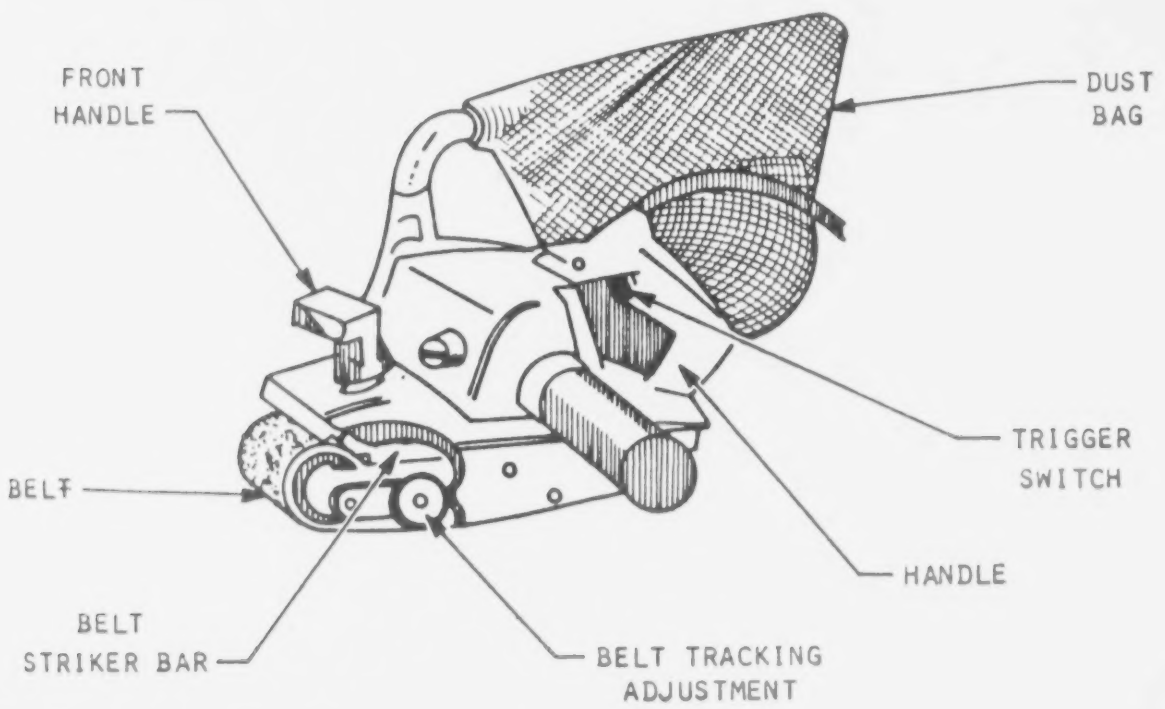
# Portable Belt Sander

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. CHECK TO SEE IF THE BELT IS WORN OR TORN, TRACKING PROPERLY, AND IS THE CORRECT GRIT SIZE FOR THE JOB.
2. BEFORE CONNECTING TO A POWER SOURCE MAKE SURE THE SWITCH IS "OFF".
3. START SANDER ABOVE THE WORK, LET REAR OF BELT TOUCH FIRST THEN LEVEL THE TOOL.
4. KEEP THE SANDER MOVING BACK AND FORTH IN THE DIRECTION OF THE GRAIN. DO NOT PAUSE IN ONE SPOT.
5. LIFT THE SANDER OFF THE STOCK WHEN STOPPING.
6. ALWAYS ALLOW THE SANDER TO COME TO A COMPLETE STOP BEFORE PLACING THE SANDER ON THE TABLE.
7. KEEP ELECTRICAL CORD AND DUST BAG AWAY FROM WORKING AREA.
8. WHEN CHANGING BELTS MAKE SURE THE NEW BELT RUNS AS THE ARROW INDICATES.



NAME _____

DATE _____ GRADE _____

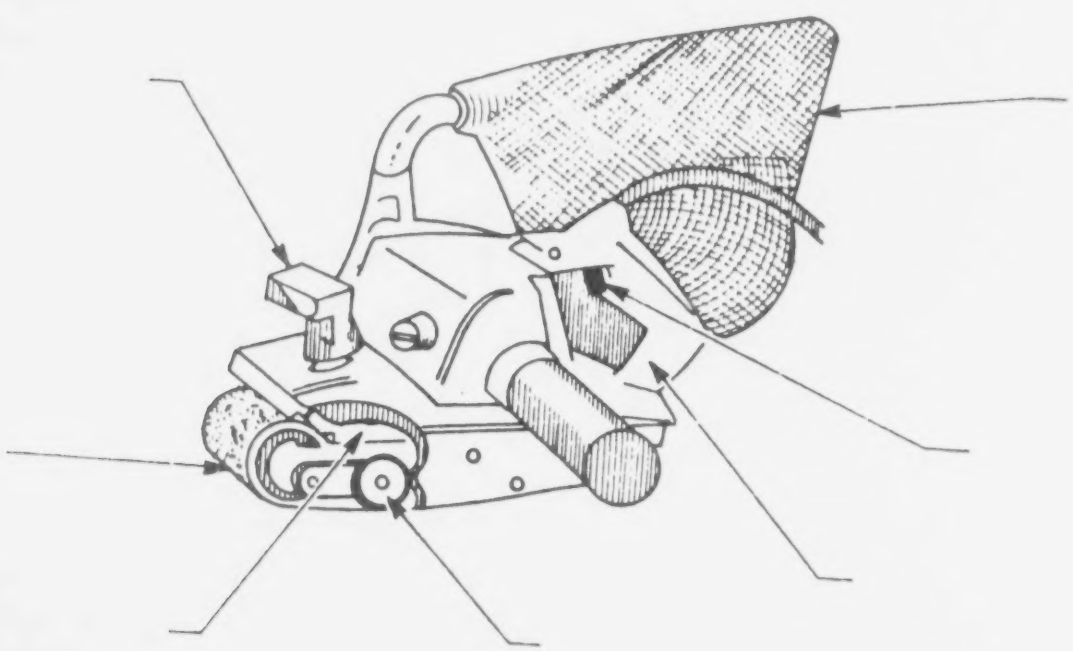
# Portable Belt Sander

SAFETY QUIZ

CIRCLE ONE

1. CHECK BELT TRACKING CAREFULLY BEFORE STARTING WORK. T F
2. THE MACHINE SHOULD BE AT A COMPLETE STOP BEFORE PLACING IT DOWN ON THE WORK BENCH. T F
3. THE SANDER SHOULD BE STARTED AFTER IT IS ON THE WORK. T F
4. SEE THAT THE TRIGGER SWITCH IS "OFF" BEFORE PLUGGING IN THE MACHINE. T F
5. THE BELT SHOULD BE MOUNTED ACCORDING TO THE DIRECTION OF THE ARROW. T F
6. KEEP ELECTRICAL CORD AWAY FROM WORKING AREA. T F

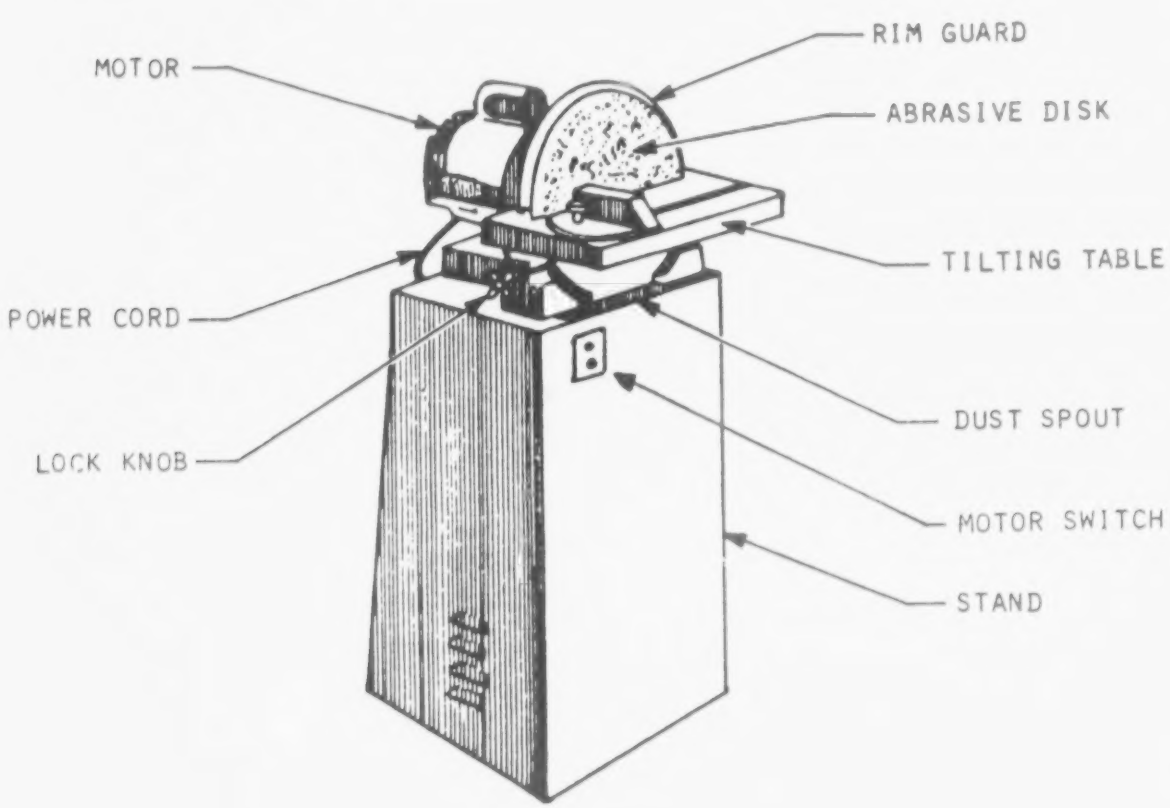
IDENTIFY PARTS



# Disc Finishing Sander

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. MAKE SURE ADHESIVE IS HOLDING THE ABRASIVE DISC TIGHTLY TO THE REVOLVING PLATEN.
2. CHECK ABRASIVE DISC FOR TEARS OR DAMAGE.
3. THE TABLE SHOULD BE ADJUSTED TO WITHIN 1/16" OF THE DISC.
4. WORK MUST BE DONE ON THE SIDE OF THE DISC ROTATING DOWNWARD.
5. MACHINE SAND ONLY OBJECTS LARGE ENOUGH TO HOLD SAFELY AGAINST THE SANDER.
6. MATERIAL SHOULD BE HELD FLAT AGAINST THE TABLE, AND HANDS KEPT CLEAR OF THE ABRASIVE DISC.
7. KEEP WORK MOVING EVENLY AND STEADILY OVER THE ABRASIVE SURFACE OF THE SANDER.
8. APPLY ONLY SUFFICIENT PRESSURE TO SMOOTH SURFACE BEING SANDED.
9. DO NOT LEAVE MACHINE UNTIL IT HAS COASTED TO A FULL STOP OR HAS BEEN STOPPED WITH A PIECE OF SCRAP WOOD.



NAME _____

DATE _____ GRADE _____

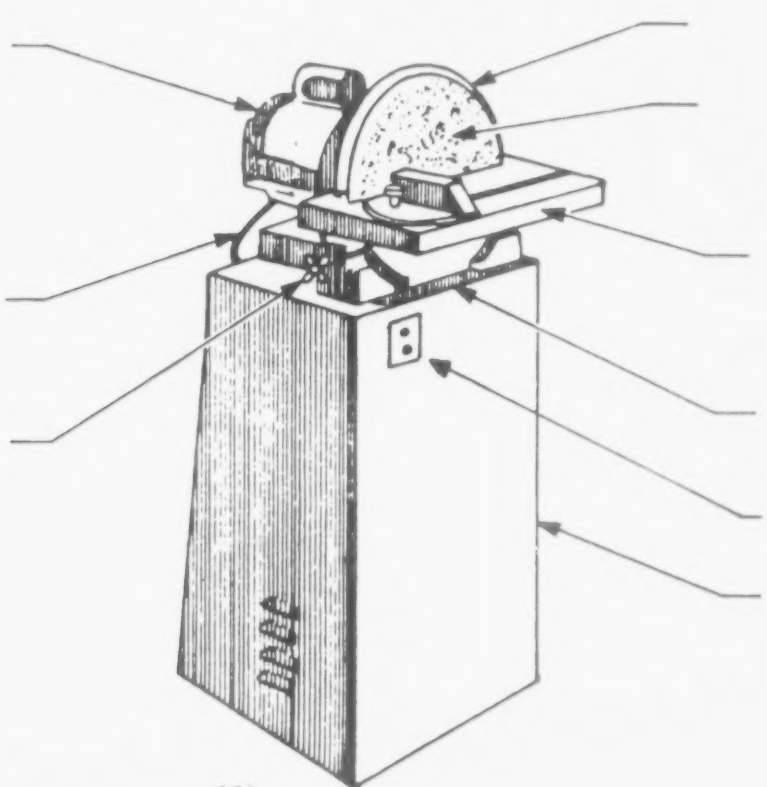
# Disc Finishing Sander

SAFETY QUIZ

CIRCLE ONE

1. ALL ADJUSTMENTS ARE TO BE MADE WITH THE POWER OFF. T F
2. THE TABLE MUST BE ¼" AWAY FROM THE DISC. T F
3. SANDING CAN BE DONE TO EITHER SIDE OF THE DISC CENTER. T F
4. THE DISC CAN BE STOPPED BY JAMMING A PIECE OF SCRAP WOOD INTO THE MACHINE. T F
5. SANDING CAN BE DONE WITHOUT THE USE OF THE TABLE. T F
6. INSPECT ABRASIVE DISC FOR DAMAGE BEFORE TURNING THE MACHINE ON. T F

IDENTIFY PARTS



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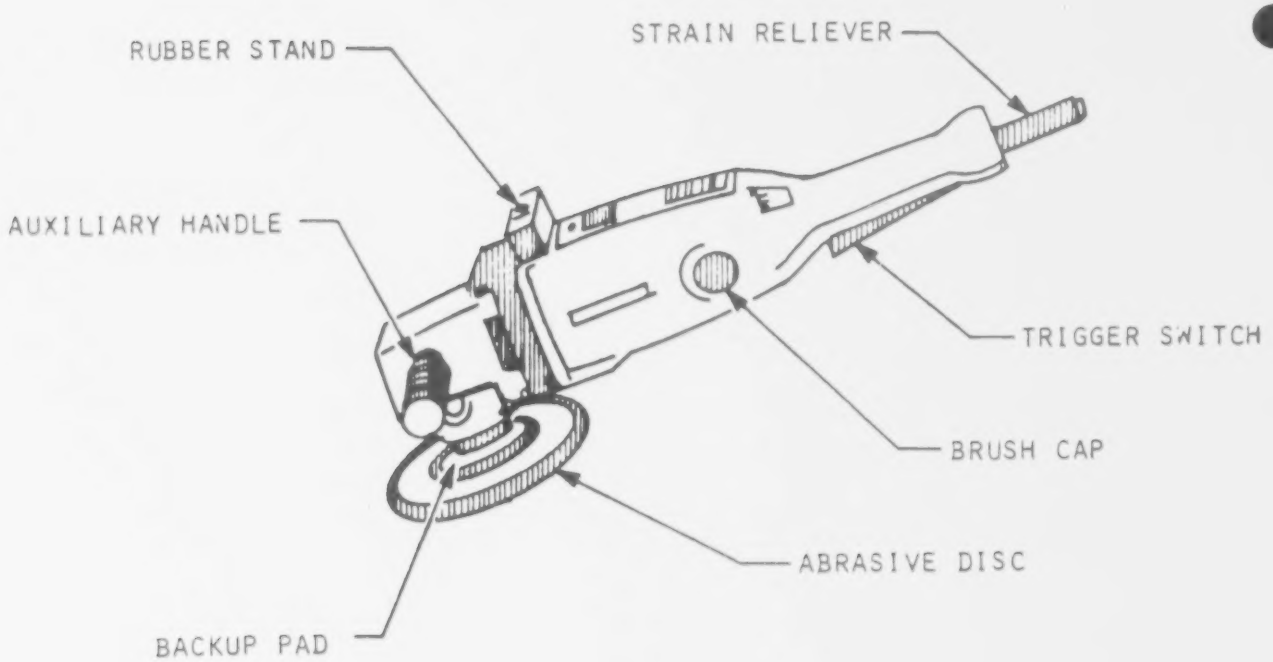
# Portable Disc Sander

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BE SURE SWITCH IS IN THE "OFF" POSITION BEFORE CONNECTING THE POWER SOURCE.
2. MAKE ALL ADJUSTMENTS TO PAD AND DISC BEFORE TURNING ON THE POWER.
3. DO NOT ALLOW THE EDGE OF THE DISC TO TOUCH THE EDGE OF THE STOCK.
4. STAND CLEAR OF THE SPARK LINE OR SPARK AREA.
5. SAND WITH A STROKING MOTION; DO NOT PAUSE IN ONE SPOT.
6. WHEN FINISHED, DISCONNECT FROM POWER SOURCE AND PLACE ON SANDER'S BACK.



NAME _____

DATE _____ GRADE _____

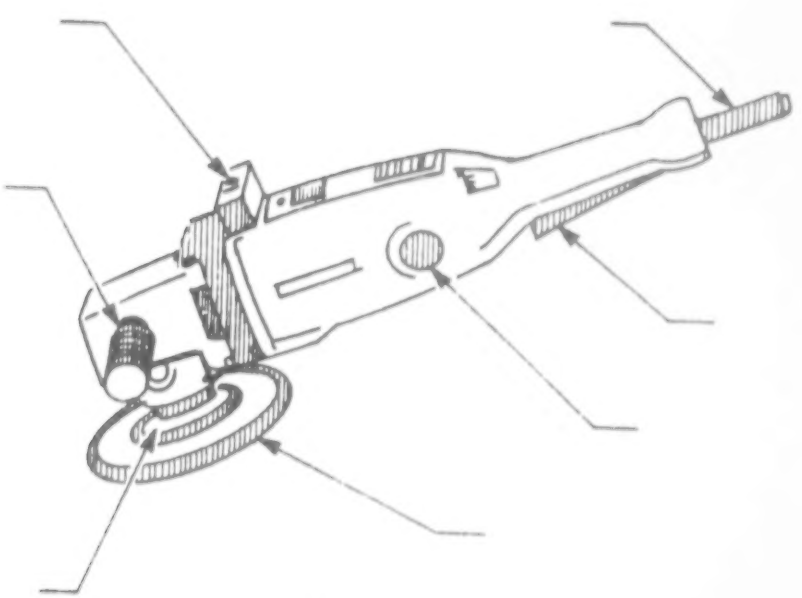
# Portable Disc Sander

SAFETY QUIZ

CIRCLE ONE

1. THE SPARKS CAUSED BY GRINDING OR SANDING ARE WARM BUT NOT DANGEROUS. T F
2. IN ORDER TO REMOVE MATERIAL FAST, IT IS SAFE TO GRIND STEADY IN ONE SPOT. T F
3. IT IS ADVISABLE TO WEAR PROTECTIVE CLOTHING WHILE USING THIS TOOL. T F
4. MAKE ALL ADJUSTMENTS BEFORE TURNING ON THE POWER. T F
5. THE GRINDER OR SANDER SHOULD BE UNPLUGGED AND SET ON ITS BACK WHEN NOT IN USE. T F

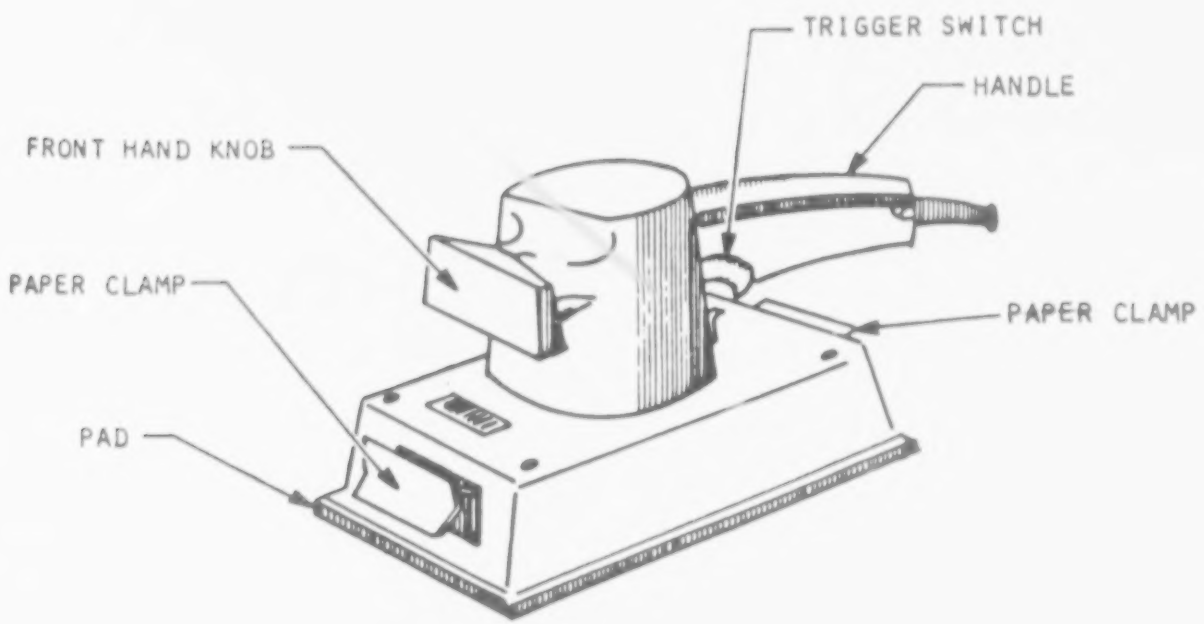
IDENTIFY PARTS



# Portable Finishing Sander

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BEFORE CONNECTING THE POWER CORD BE SURE THE POWER SWITCH IS "OFF"
2. CHECK TO SEE THAT THE ABRASIVE SHEET IS IN GOOD CONDITION AND INSTALLED PROPERLY.
3. START THE SANDER ABOVE THE WORK AND SIT IT DOWN EVENLY; MOVE SLOWLY OVER A WIDE AREA.
4. LIFT THE SANDER FROM THE WORK BEFORE STOPPING THE MOTOR.
5. BE SURE THE SANDER HAS STOPPED BEFORE PLACING THE SANDER ON THE WORK BENCH.
6. ALL WORK MUST BE SECURELY FASTENED IN THE HOLDING DEVICE.



NAME _____

DATE _____ GRADE _____

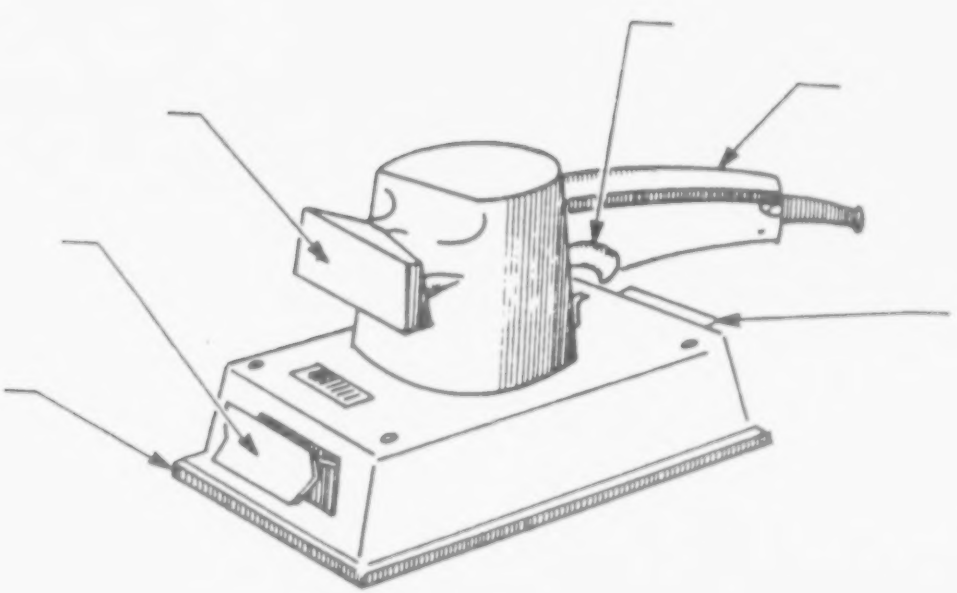
# Portable Finishing Sander

SAFETY QUIZ

CIRCLE ONE

1. BE SURE TRIGGER SWITCH IS IN THE "OFF" POSITION WHEN PLUGGING IN. T F
2. CHECK THE ABRASIVE SHEET TO SEE IF IT IS SECURE. T F
3. HOLD THE SANDER BY THE CORD. T F
4. PULL THE POWER CORD TO REMOVE THE PLUG FROM THE SOCKET. T F
5. TURN ON THE SANDER BEFORE PLACING IT ON THE WORK. T F
6. TURN THE SANDER OFF WHILE IT IS ON THE WORK PIECE. T F

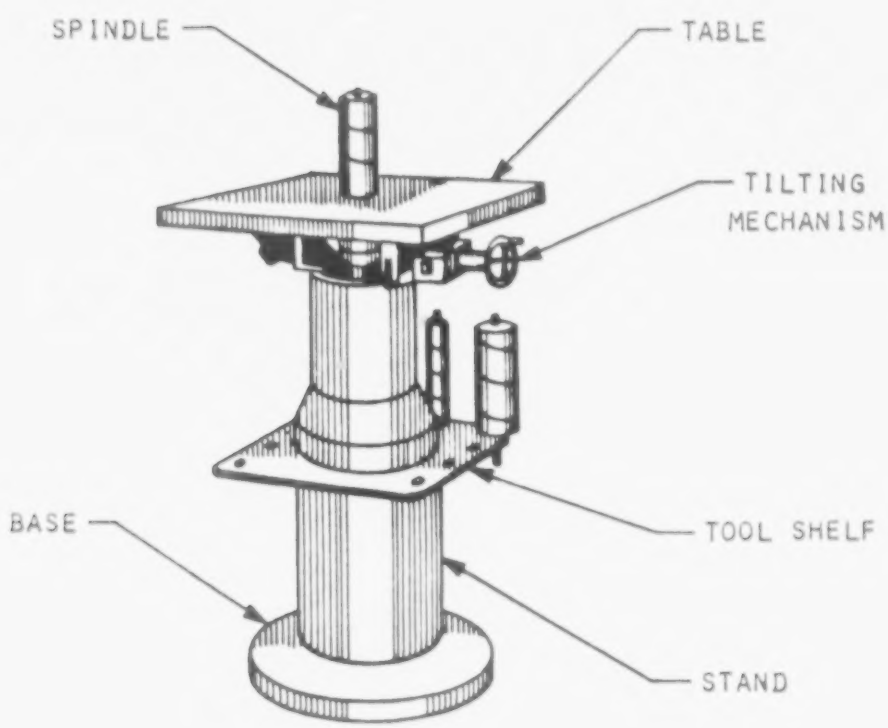
IDENTIFY PARTS



# Spindle Sander

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BE SURE ALL GUARDS ARE IN PLACE AND OPERATING PROPERLY.
2. CHECK TO SEE THAT THE SPINDLE IS SECURELY POSITIONED IN THE ARBOR. IT SHOULD NOT WOBBLE BUT SPIN SMOOTHLY.
3. DO NOT FORCE THE MATERIAL AGAINST THE SPINDLE. ALLOW THE SPINDLE SLEEVE TO DO THE SANDING.
4. DO NOT PLACE HANDS OR HEAD OVER THE SPINDLE TOP.
5. PERIODICALLY TIGHTEN THE RETAINING NUT ON TOP OF THE SPINDLE.
6. NEVER CLEAR AWAY SAW DUST FROM THE SPINDLE AREA UNTIL THE MACHINE HAS COME TO A COMPLETE STOP.



NAME _____

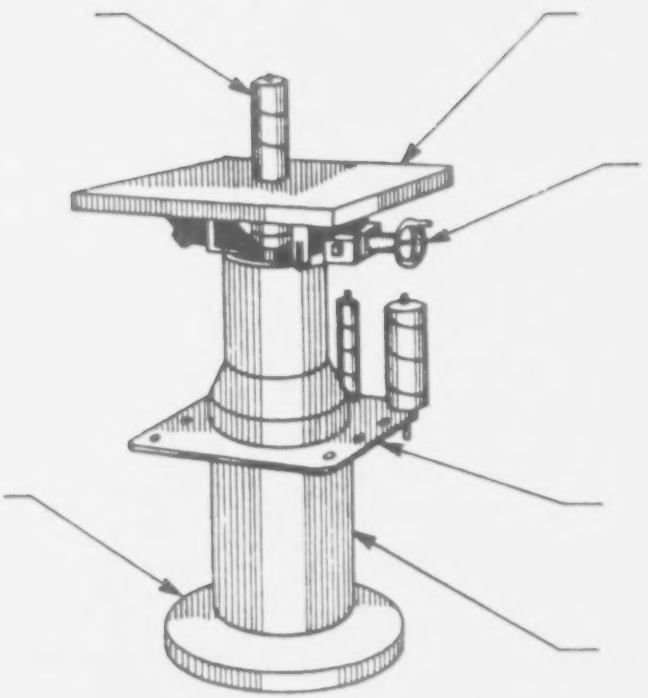
DATE _____ GRADE _____

# Spindle Sander

SAFETY QUIZ — CIRCLE ONE

1. EYE PROTECTION NEED NOT BE WORN. T F
2. PRESSURE AGAINST THE SLEEVE IMPROVES SANDING SPEED. T F
3. LOOSE CLOTHING IS PERMISSIBLE WHILE USING THIS MACHINE. T F
4. THE SPINDLE SHOULD REVOLVE SMOOTHLY WHEN IT IS TURNED BY HAND. T F
5. DUST SHOULD BE REMOVED WHILE THE MACHINE IS ON. T F

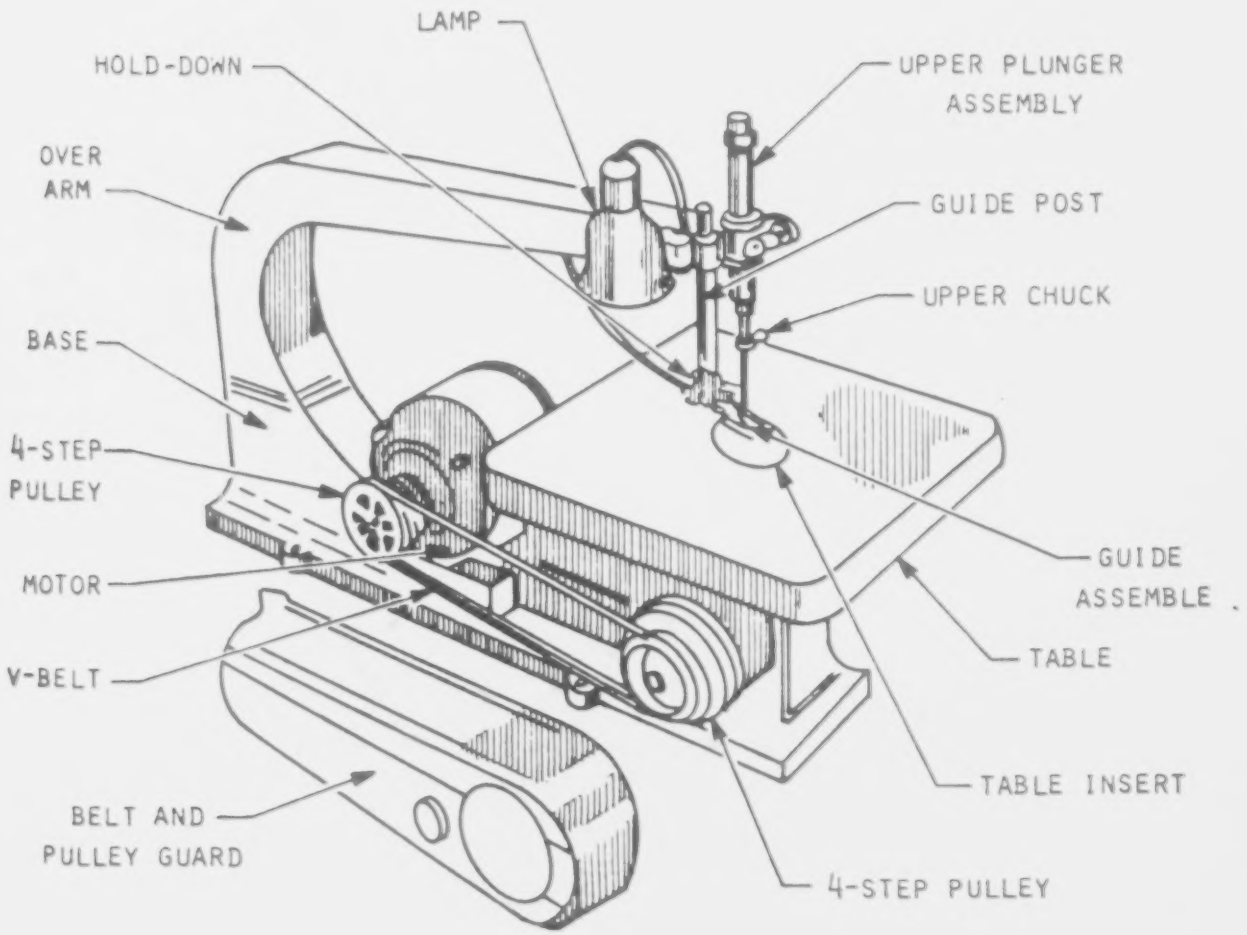
IDENTIFY PARTS



# Scroll Saw

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. MAKE ALL ADJUSTMENTS WITH THE POWER OFF, THEN ROTATE THE MOTOR BY HAND AS A FINAL CHECK.
2. BE SURE THE HOLD DOWN IS PRESSING LIGHTLY ON THE STOCK.
3. THE BLADE, WITH TEETH POINTING DOWNWARD, SHOULD BE HELD FIRMLY IN THE CHUCK, AND BE PROPERLY SUPPORTED BY THE GUIDE ASSEMBLY.
4. GUIDE THE STOCK SLOWLY THROUGH THE MACHINE WITH BOTH HANDS, KEEPING FINGERS AWAY FROM THE CUT LINE.
5. DO NOT TRY TO CLEAR CHIPS AROUND THE BLADE BY HAND. USE THE CHIP BLOWER.
6. CHOOSE THE CORRECT BLADE AND SPEED FOR THE STOCK TO BE CUT, AND FOR THE SMALLEST RADIUS REQUIRED.



NAME _____

DATE _____ GRADE _____

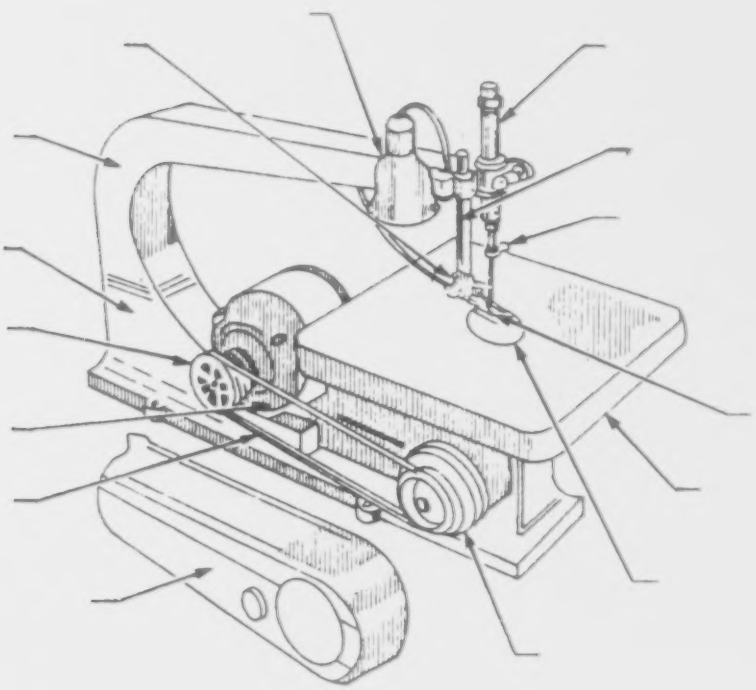
# Scroll Saw

SAFETY QUIZ

CIRCLE ONE

1. TO CHECK ADJUSTMENTS TO THE BLADE, ROTATE THE MOTOR BY HAND. T F
2. THE HOLD-DOWN SHOULD LIGHTLY REST ON THE WORK. T F
3. CHIPS SHOULD BE REMOVED AS YOU CUT THE MATERIAL. T F
4. AVOID BACKING OUT THE WORK FROM THE BLADE. T F
5. DO NOT TURN THE MATERIAL TOO SHARPLY AS THE BLADE MAY BREAK. T F

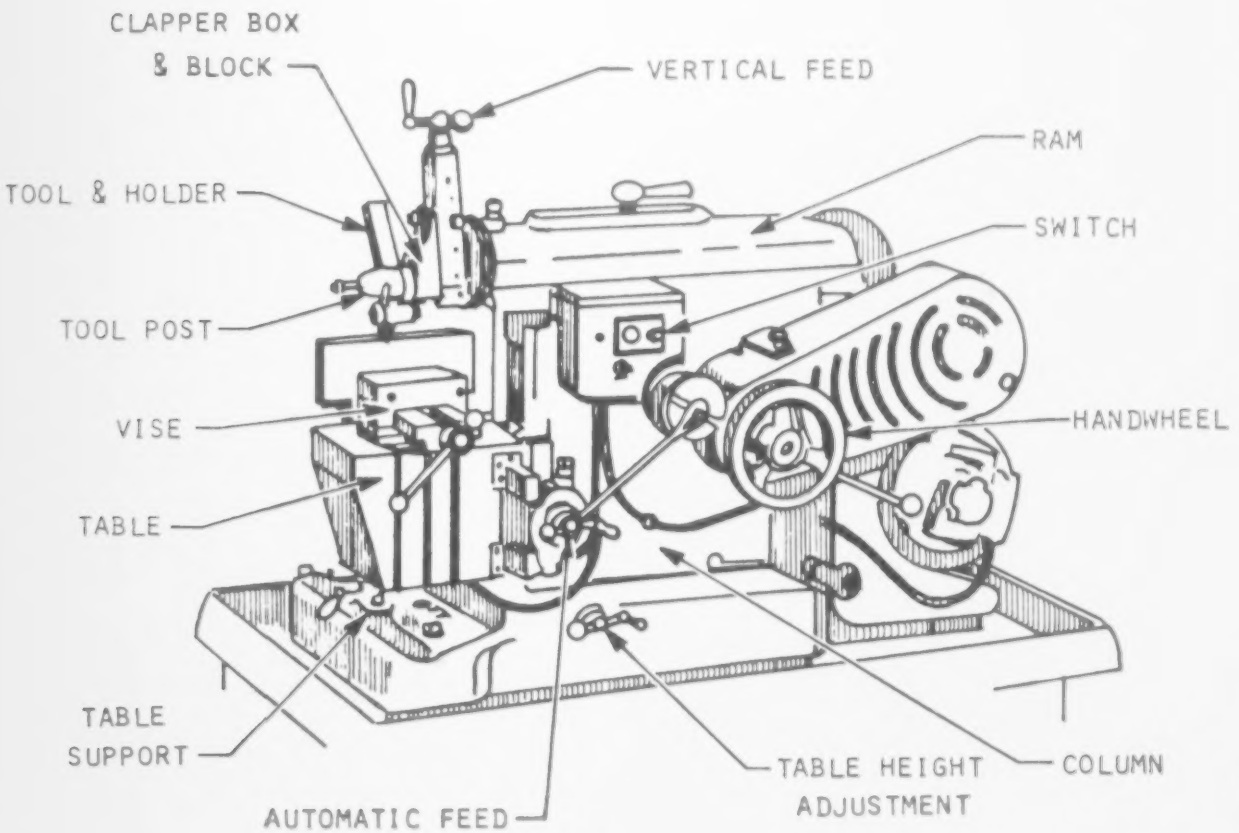
IDENTIFY PARTS



# Metal Shaper

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. MAKE ADJUSTMENTS WHILE THE MACHINE IS STOPPED, AND RUN THROUGH ONE CYCLE BY HAND AS A CHECK FOR CLEARANCE.
2. CHECK TO SEE THAT STARTING LEVER IS IN A NEUTRAL POSITION AND THAT ALL GUARDS ARE SECURED BEFORE STARTING THE MACHINE.
3. BE SURE THE WORK PIECE IS SECURELY HELD IN THE VISE OR HOLDING DEVICE.
4. AVOID STANDING DIRECTLY IN FRONT OF THE RAM.
5. KEEP HANDS AWAY FROM THE WORK POINT OR POSSIBLE PINCH POINT OR THE SHAPER.
6. DO NOT LAY TOOLS OR TOOLING ON ANY PART OF THE MACHINE.
7. NEVER REMOVE CHIPS WHILE THE MACHINE IS IN MOTION.
8. ALWAYS USE A SMALL BRUSH TO REMOVE CHIPS. BARE HANDS SHOULD NEVER BE USED.
9. BEFORE LEAVING, MAKE SURE THE SHAPER COMES TO A FULL STOP.



NAME _____

DATE _____ GRADE _____

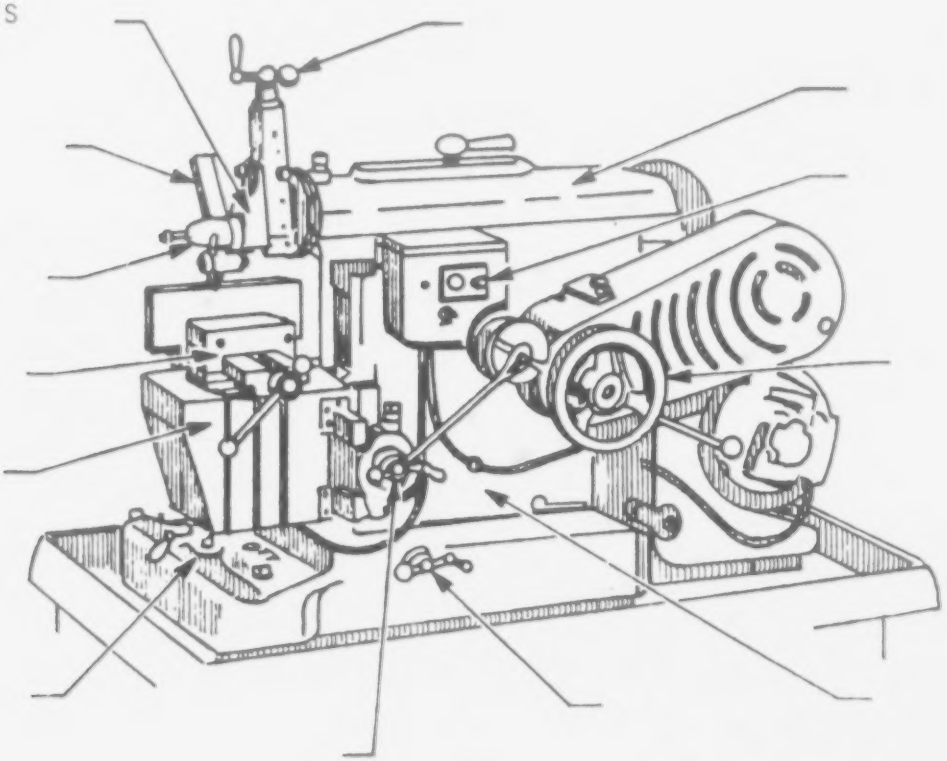
# Metal Shaper

SAFETY QUIZ

CIRCLE ONE

1. IT IS PERMISSIBLE TO STAND IN FRONT OF THE MACHINE WHILE IT IS RUNNING. T F
2. SECURE STOCK IN A HOLDING DEVICE. T F
3. A HEAVY CUT MAY GET THE JOB DONE MORE QUICKLY BUT ALSO COULD BE UNSAFE. T F
4. CHIPS MAY BE QUICKLY REMOVED WHILE THE MACHINE IS RUNNING. T F
5. ALL CLEARANCES SHOULD BE CHECKED BEFORE THE RAM IS SET IN MOTION. T F
6. EYE PROTECTION MUST BE WORN. T F

IDENTIFY PARTS



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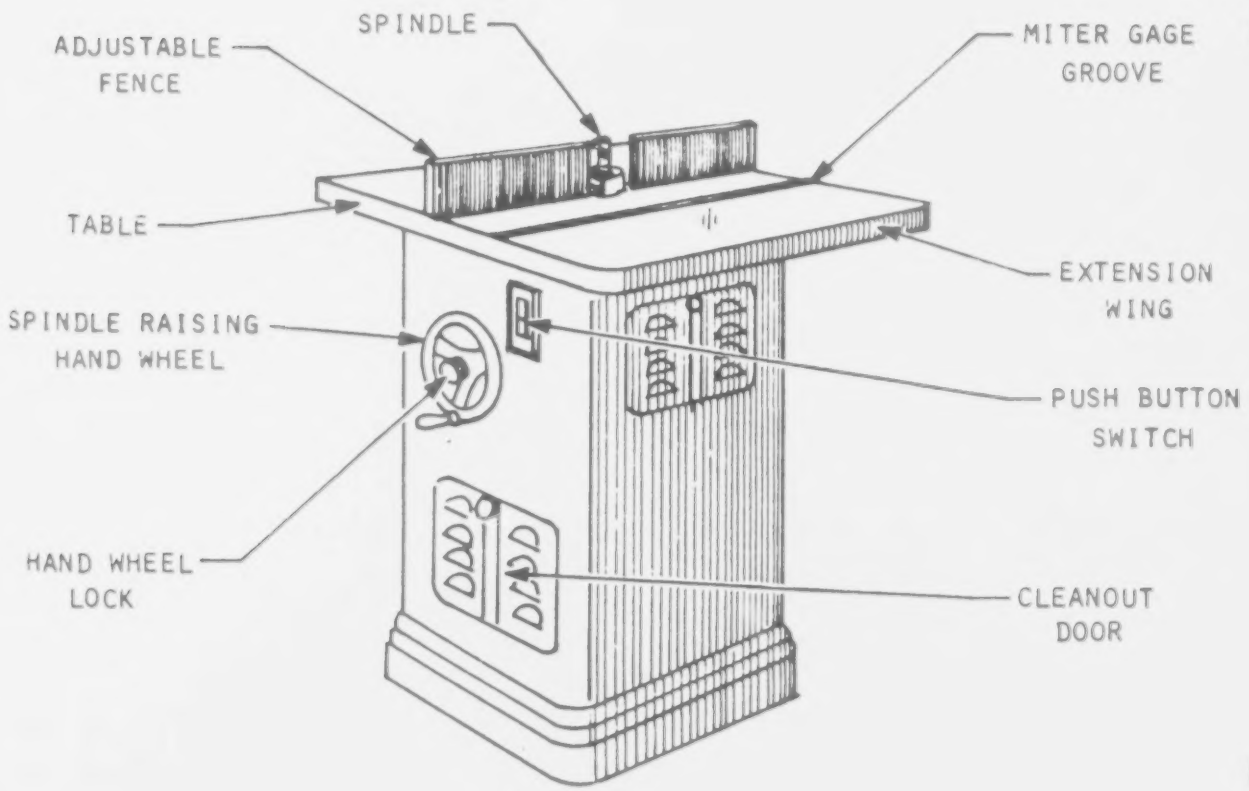
# Wood Shaper

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. MAKE ADJUSTMENTS TO CUTTER, FENCE, AND GUARDS BEFORE TURNING ON THE MACHINE.
2. MOUNT THE CUTTER SO THAT MOST OF THE CUTTING WILL BE PERFORMED ON THE LOWER PART OF THE EDGE.
3. USE GUARDS, FEATHER BOARDS, AND HOLD-DOWN DEVICES WHENEVER POSSIBLE.
4. KEEP HANDS AT LEAST 4" AWAY FROM THE CUTTER.
5. CUT ONLY NEW STOCK THAT IS STRAIGHT AND TRUE AND FREE OF SPLITS, CHECKS, AND KNOTS.
6. ALWAYS USE A STARTING PIN FOR FREEHAND SHAPING.
7. USE THE SMALLEST TABLE INSERT POSSIBLE.
8. BRUSH AWAY DUST AND CHIPS ONLY WHEN THE MACHINE IS STOPPED.



NAME _____

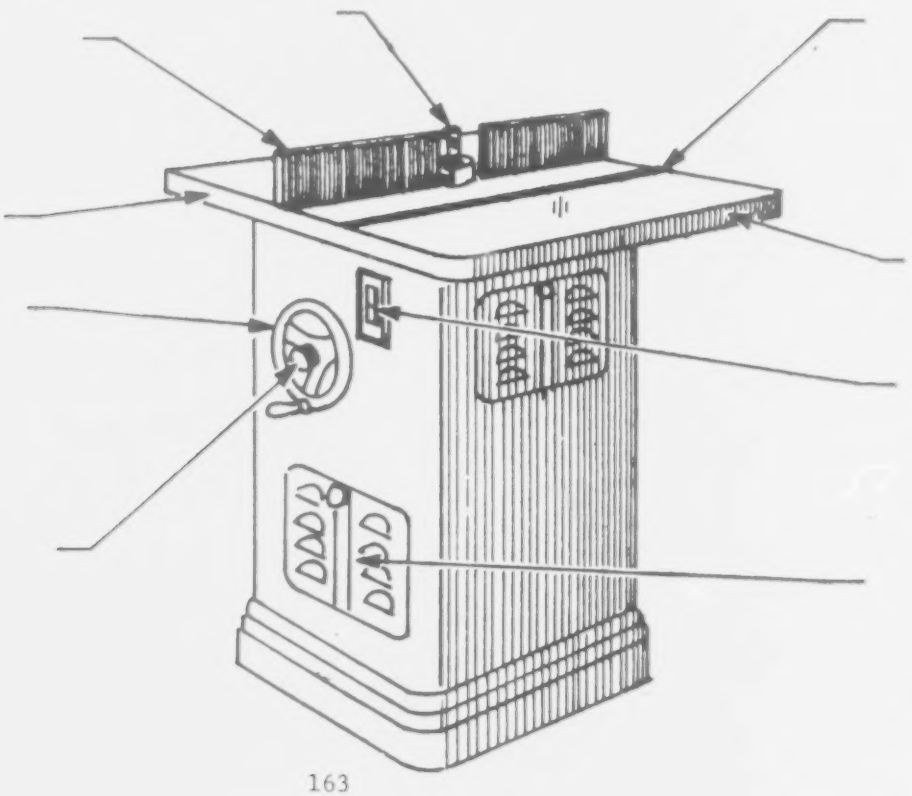
DATE _____ GRADE _____

# Wood Shaper

SAFETY QUIZ — CIRCLE ONE

1. IN MOST CASES, GUARDS AND HOLD-DOWNS ONLY GET IN THE WAY. T F
2. OFTEN, SPECIAL OR CUSTOM FIXTURES MUST BE MADE TO DO A JOB SAFELY. T F
3. A STARTING PIN IS NOT NECESSARY. T F
4. THE LARGEST TABLE INSERT SHOULD ALWAYS BE USED. T F
5. A BRUSH SHOULD BE USED TO BRUSH AWAY CHIPS WHEN THE MACHINE IS RUNNING. T F
6. HANDS SHOULD BE KEPT AT LEAST 2" AWAY FROM THE CUTTER. T F

IDENTIFY PARTS



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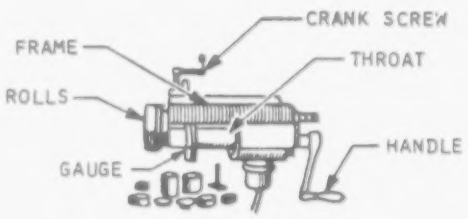
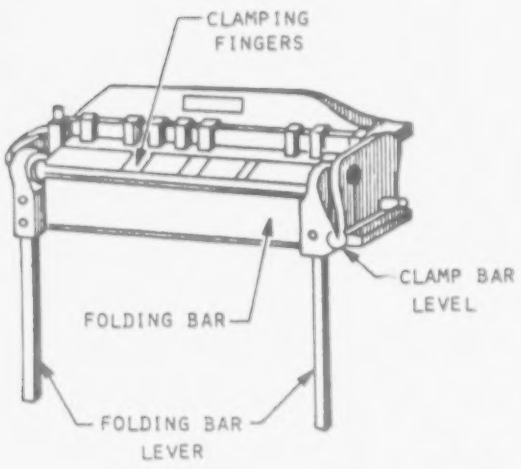
# Sheet Metal Machines

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

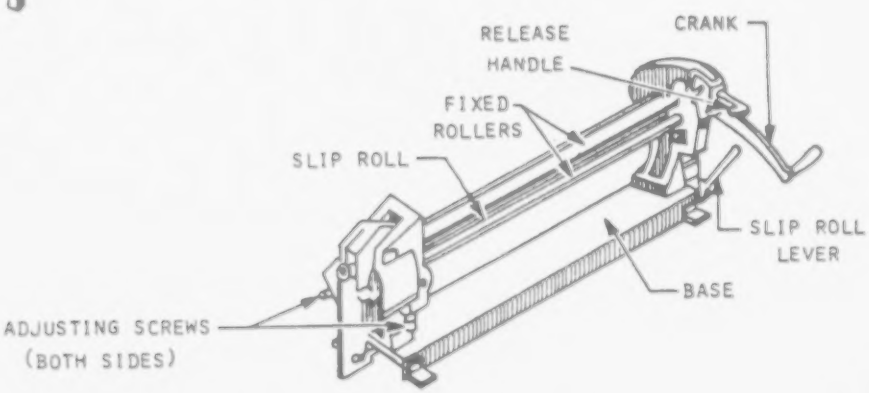
1. KEEP HANDS AND FINGERS CLEAR OF CLAMPS, JAWS, AND ROTATING PARTS.
2. NEVER BEND, ROLL, CRIMP, OR BEAD METAL WHICH EXCEEDS THE CAPACITY OF THE MACHINE.
3. MAKE ALL ROLLS AND BENDS SMOOTHLY AND STEADILY.
4. WORK WITH ONLY ONE PIECE OF METAL AT A TIME.
5. REMOVE BURRS FROM THE METAL BEFORE ATTEMPTING TO WORK IT IN THE MACHINE.
6. OBTAIN HELP WHEN WORKING WITH LARGE PIECES OF STOCK.
7. NEVER FORCE HIT OR DROP LEVERS OR HANDLES.




ROTARY MACHINE




BOX & PAN BRAKE




SLIP ROLL FORMING MACHINE

NAME _____

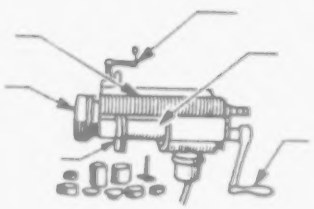
DATE _____ GRADE _____

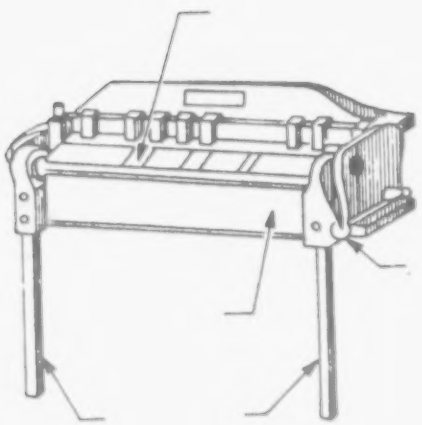
# Sheet Metal Machines

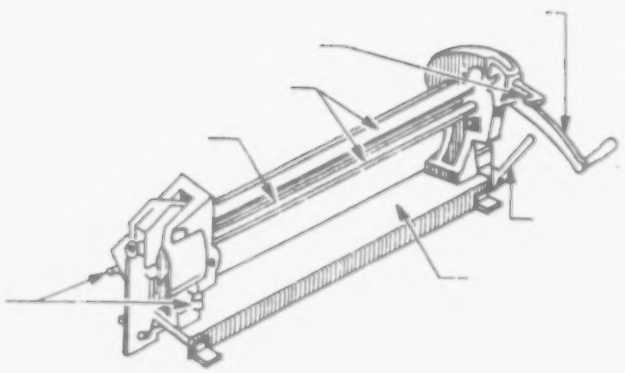
SAFETY QUIZ — CIRCLE ONE

1. SHEET METAL MACHINES CAN BE DAMAGED BY OVERLOADING. T F
2. SHARP BURRS AND EDGES SHOULD BE REMOVED BEFORE ATTEMPTING TO PLACE STOCK IN MACHINE. T F
3. FINGERS MUST BE KEPT CLEAR OF MOVING PARTS. T F
4. QUARTER-INCH MILD STEEL STOCK CAN BE FORMED ON THE SHEET METAL MACHINE. T F
5. IF A HANDLE JAMS, IT CAN BE TAPPED LIGHTLY WITH A HAMMER. T F

IDENTIFY PARTS



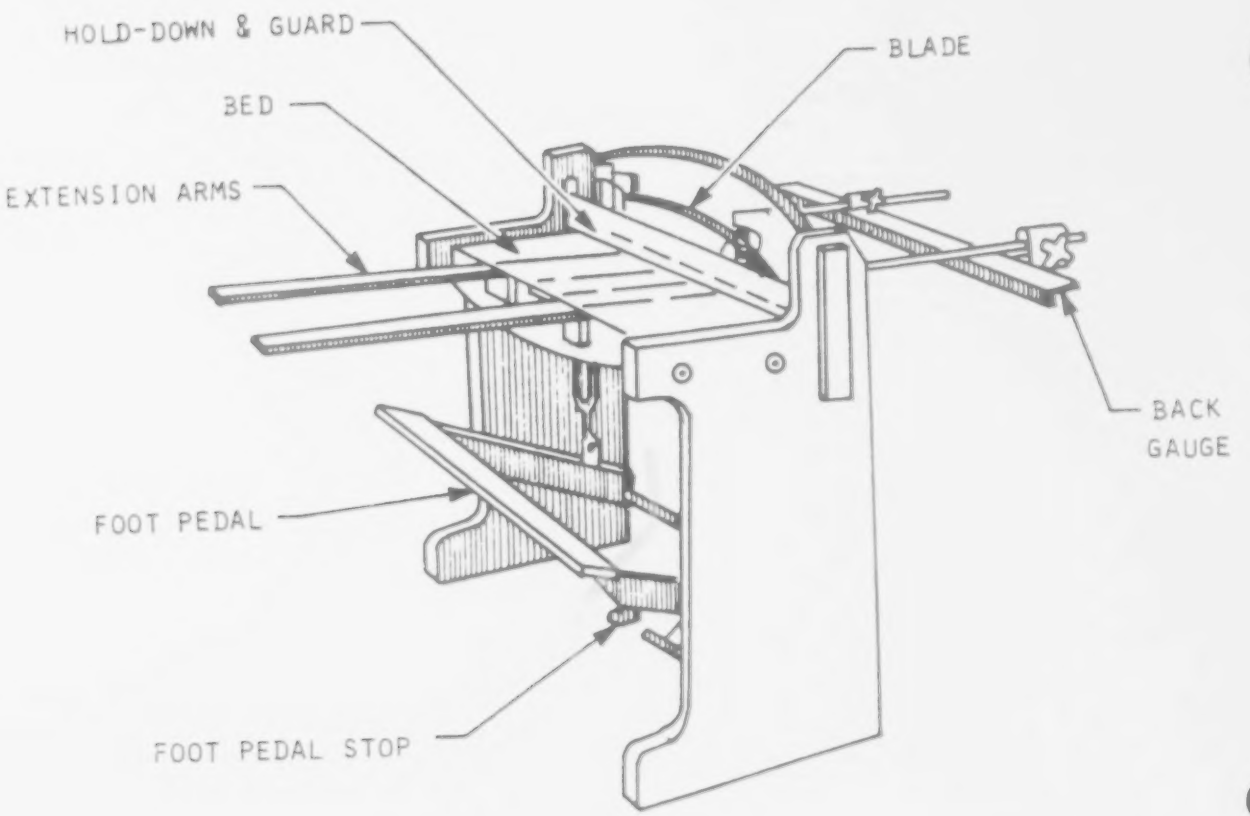




# Squaring Shear

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. SEE THAT ALL GUARDS ARE FUNCTIONING PROPERLY BEFORE STARTING.
2. METAL THICKNESS SHOULD NOT EXCEED THE CAPACITY OF THE MACHINE.
3. USE GLOVES WHEN HANDLING LARGE PIECES OF SHEET METAL, AND REMOVE OBVIOUS BURRS FROM ALL PIECES.
4. DO NOT ALLOW FINGERS TO EXTEND PAST THE GUARD.
5. MAKE SURE THAT THE FOOT NOT BEING USED TO OPERATE THE FOOT PEDAL IS CLEAR BEFORE PUSHING DOWN ON THE FOOT PEDAL.
6. ALLOW SMALL PIECES OF METAL BEING CUT TO DROP TO THE FLOOR OR INTO A CONTAINER.
7. STAND AND OPERATE ONLY FROM THE FRONT OF THE MACHINE.
8. BE CAREFUL OF SHARP OR JAGGED EDGES WHEN PICKING UP TRIMMINGS.



NAME _____

DATE _____ GRADE _____

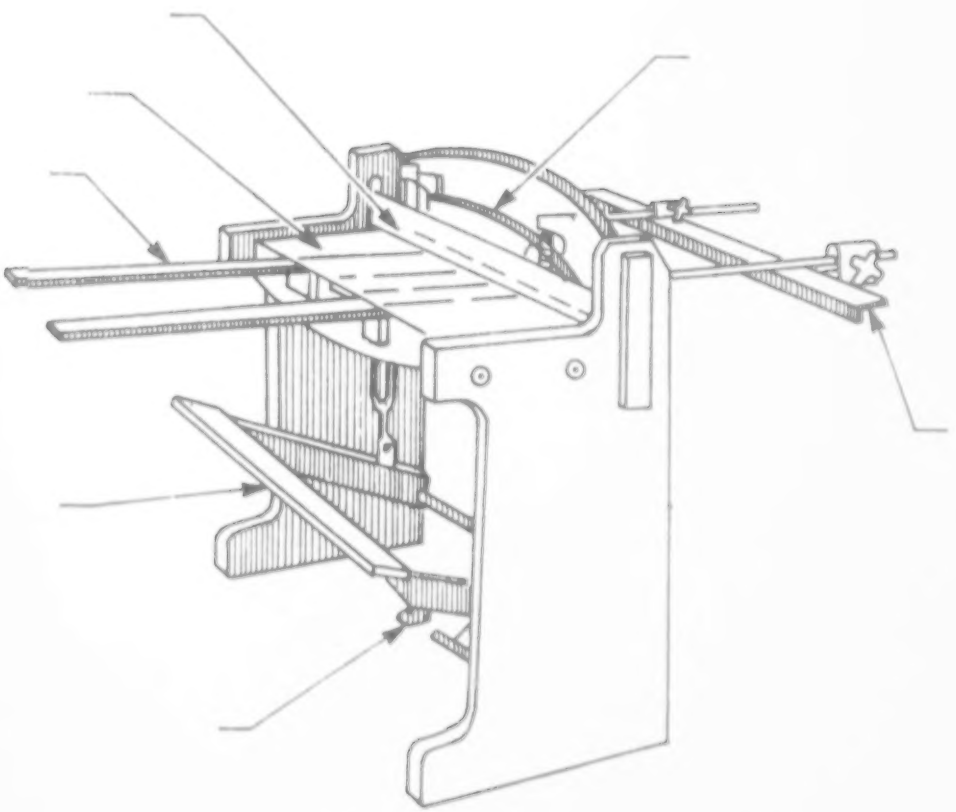
# Squaring Shear

SAFETY QUIZ

CIRCLE ONE

1. HEAVY METAL MAY BE CUT ON THE SHEAR. T F
2. GLOVES SHOULD BE USED WHEN HANDLING SHEET METAL. T F
3. FEED AND OPERATE THE SHEAR FROM THE FRONT. T F
4. BOTH FEET SHOULD BE USED TO OPERATE THE SHEAR. T F
5. THE SHEAR IS AN EXCELLENT MACHINE FOR CUTTING ROD. T F
6. BE SURE TO CATCH SMALL PIECES AS THEY ARE CUT. T F

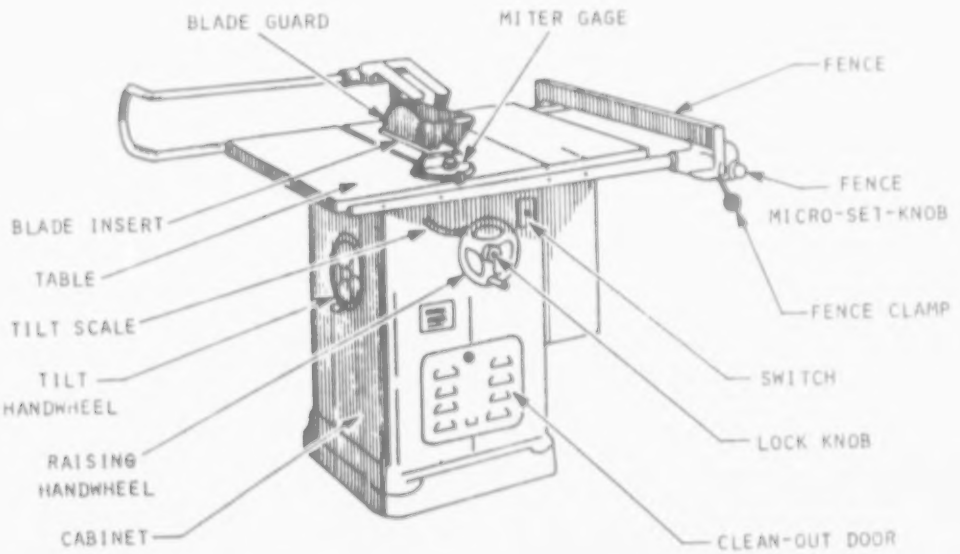
IDENTIFY PARTS



# Table Saw

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. ADJUST THE BLADE, JUST HIGH ENOUGH TO CUT THROUGH THE STOCK, BEFORE THE POWER IS TURNED ON.
2. KEEP FINGERS AWAY FROM MOVING PARTS AND NEVER REACH OVER THE SAW BLADE.
3. NEVER MAKE A CUT WITHOUT USING THE PROPER FENCES OR GAUGES.
4. BE SURE THAT THE BLADE WILL CLEAR BOTH SIDES OF THE THROAT PLATE BEFORE TURNING ON THE POWER.
5. MAKE NO ADJUSTMENTS WHILE THE MACHINE IS RUNNING.
6. NEVER ATTEMPT TO CLEAR AWAY SCRAPS WHILE THE BLADE IS RUNNING.
7. BEFORE BEGINNING ANY "SPECIAL" CUTS, ALWAYS HAVE THE INSTRUCTOR CHECK THE SETUP.
8. DO NOT ALLOW FINGERS TO COME INTO DIRECT LINE WITH THE BLADE.
9. EXERCISE ADDITIONAL CARE WHEN SAWING LARGE STOCK.
10. DO NOT CUT CYLINDRICAL STOCK ON THIS MACHINE.
11. WHEN STARTING WORK OR ON SPECIAL SETUPS, CYCLE THE SWITCH QUICKLY TO SEE THAT EVERYTHING IS WORKING PROPERLY.
12. CLEAN THE MACHINE AND THE AREA AROUND IT WITH A BRUSH WHEN FINISHED USING.



NAME _____

DATE _____ GRADE _____

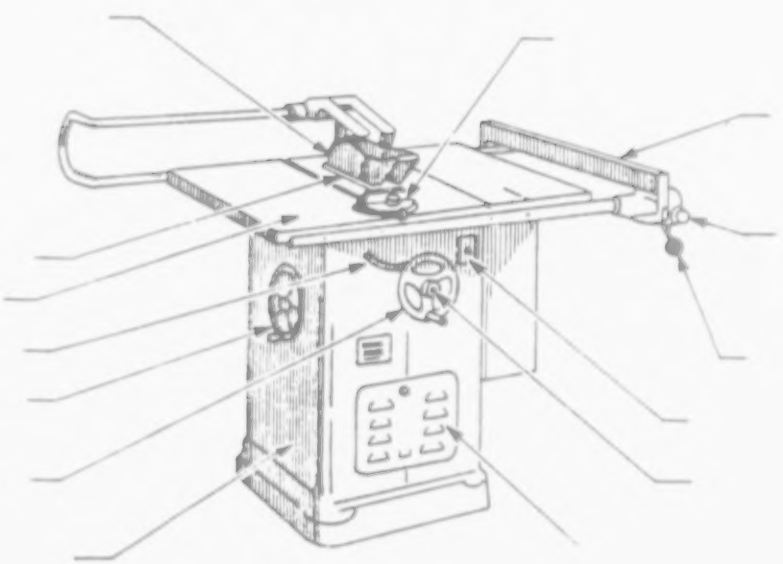
# Table Saw

SAFETY QUIZ

CIRCLE ONE

1. A PUSH STICK IS USED TO PUSH NARROW PIECES OF WOOD OFF THE SAW DURING CLEAN-UP. T F
2. YOUR ATTENTION SHOULD BE GIVEN TO THE SAW ONLY WHILE CUTTING. T F
3. THE SAW SHOULD BE SET 1/8" ABOVE THE WOOD SURFACE. T F
4. WHEN RIPPING NEVER LEAVE THE WOOD BETWEEN THE SAW BLADE AND THE MITER GUAGE. T F
5. CYLINDRICAL STOCK SHOULD NOT BE CUT ON THIS MACHINE. T F
6. THE GUARD IS NOT ALWAYS NECESSARY T F
7. STAND DIRECTLY BEHIND THE BLADE WHILE CUTTING. T F
8. ADJUSTMENTS TO THE MACHINE MUST BE MADE WHILE THE SAW IS ON. T F
9. A BOARD WHICH IS 2" NARROW MAY BE PUSHED THROUGH BY HAND. T F

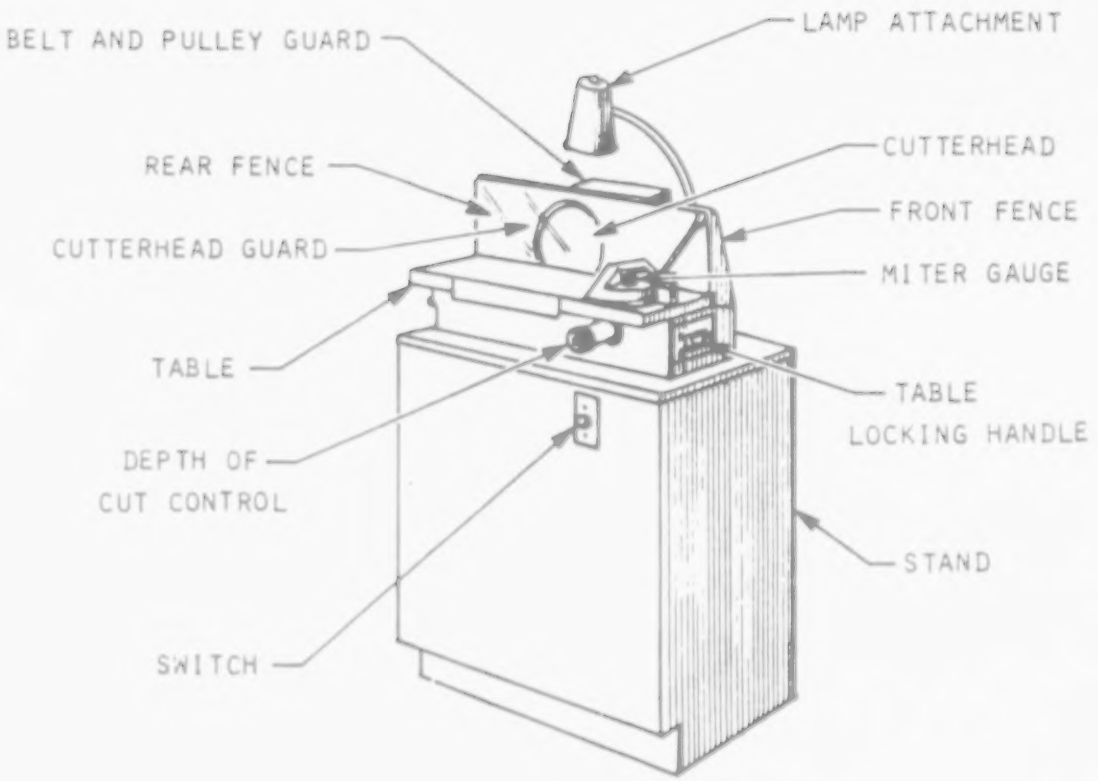
IDENTIFY PARTS



# Uniplane

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. MAKE ALL ADJUSTMENTS BEFORE TURNING ON THE MACHINE.
2. KEEP THE CUTTERHEAD FREE OF ALL GUM AND PITCH.
3. ALWAYS HOLD THE WORK FIRMLY AGAINST THE FENCE.
4. ALWAYS USE PUSH STICKS OR A PUSH BLOCK WHEN WORKING WITH SMALL STOCK.
5. GUARDS SHOULD BE USED AT ALL TIMES.
6. DO NOT BRUSH CHIPS OR SAW DUST AWAY FROM THE POINT OF OPERATION UNTIL THE MACHINE HAS COME TO A COMPLETE STOP.



NAME _____

DATE _____ GRADE _____

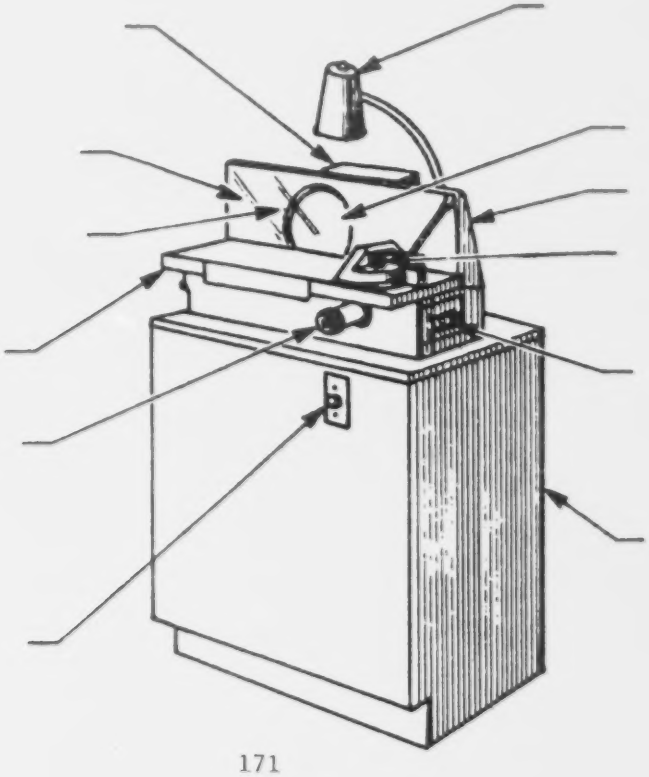
Uniplane

SAFETY QUIZ

CIRCLE ONE

1. GUARDS SHOULD BE IN POSITION AT ALL TIMES. T F
2. USE A PUSH BROOM TO REMOVE CHIPS OFF THE MACHINE. T F
3. THE WORK PIECE SHOULD BE MOVED THROUGH THE MACHINE TO THE REAR FENCE BEFORE REMOVING. T F
4. THE MACHINE MUST COME TO A FULL STOP BEFORE IT IS SAFE TO LEAVE THE WORK AREA. T F
5. ALL ADJUSTMENTS SHOULD BE MADE WITH THE POWER OFF. T F

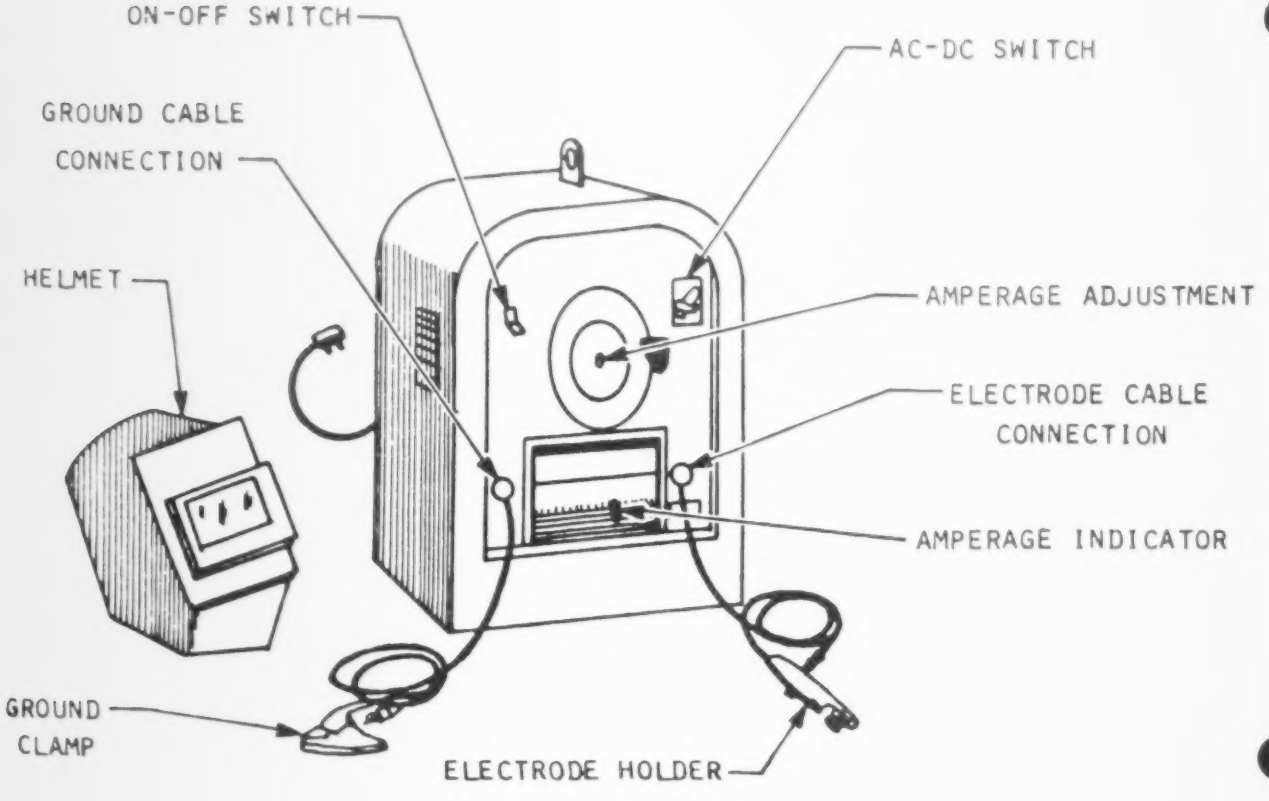
IDENTIFY PARTS



# Arc Welder

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. A WELDING HELMET WITH A CLEAN OBSERVATION WINDOW MUST BE WORN.
2. KEEP SLEEVES AND PANTS CUFF ROLLED DOWN.
3. GOGGLES MUST BE WORN FOR ALL CHIPPING OPERATIONS.
4. KEEP ALL FLAMMABLE MATERIAL AWAY FROM WORKING AREAS.
5. ALWAYS WEAR LEATHER GLOVES, APRON, AND SHOES WHEN WELDING.
6. THE FLOOR AREA SHOULD BE KEPT CLEAR OF ALL OBSTRUCTIONS.
7. CLOSED CONTAINERS SHOULD NOT BE WELDED WITHOUT INSTRUCTOR'S PERMISSION.
8. REPORT ANY OVERHEATING OF THE WELDING UNIT TO THE INSTRUCTOR AT ONCE.
9. SCREENS TO PROTECT OTHERS MUST BE IN PLACE BEFORE WELDING IS STARTED.



NAME _____

DATE _____ GRADE _____

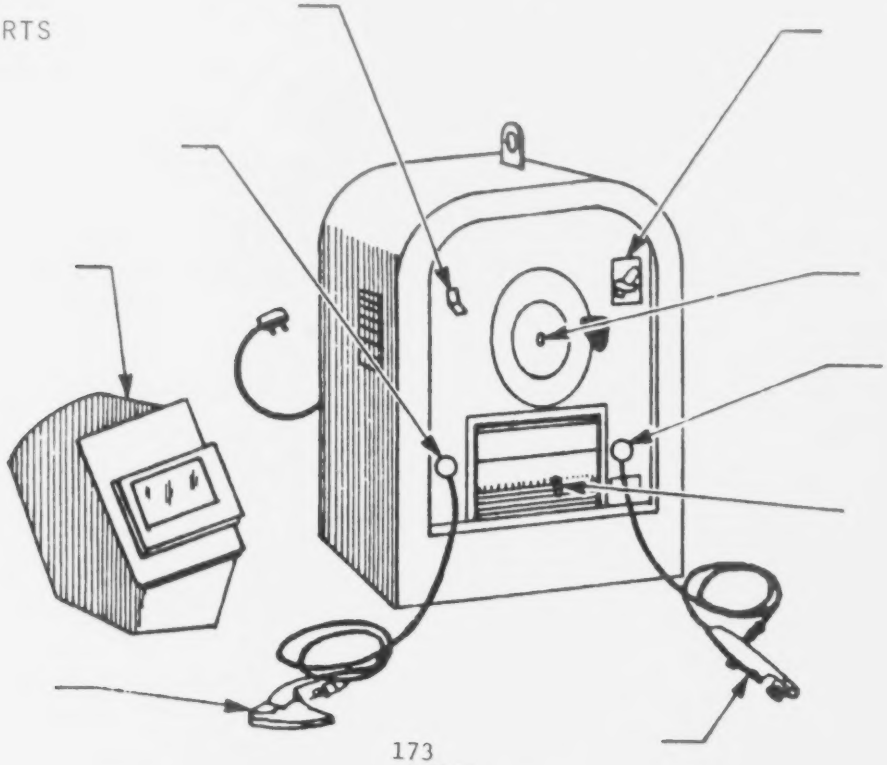
# Arc Welder

SAFETY QUIZ

CIRCLE ONE

1. FLAMMABLE MATERIALS SHOULD BE KEPT AWAY FROM WORKING AREA. T F
2. CHIPPING CAN BE DONE WITHOUT GOGGLES. T F
3. MAKE SURE ALL AROUND YOU ARE AWARE THAT YOU ARE STRIKING THE ARC. T F
4. ALWAYS WEAR A WELDING HELMET. T F
5. GLOVES AND PROTECTIVE CLOTHING ARE UNNECESSARY. T F
6. VENTILATION IS IMPORTANT DURING WELDING. T F
7. A CLOSED CONTAINER CAN BE DANGEROUS TO WELD. T F
8. THE WELDING AREA FLOOR SHOULD BE DAMP FOR A GOOD GROUND. F

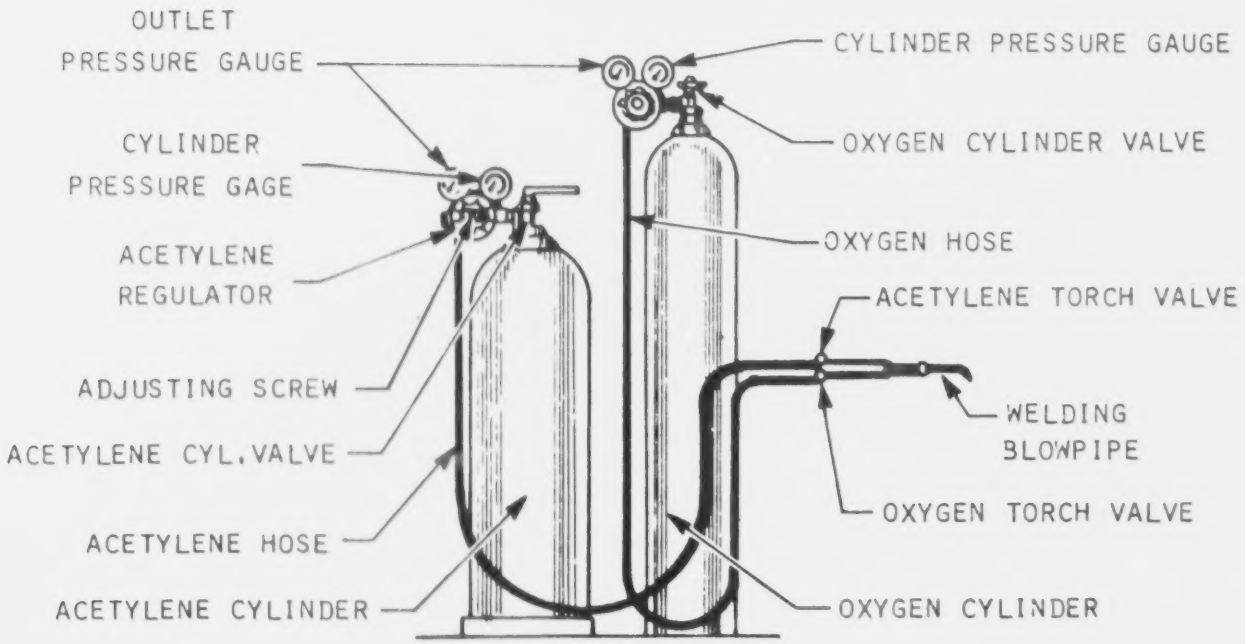
IDENTIFY PARTS



# Oxyacetylene Welder

PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. BE SURE CYLINDERS ARE FASTENED WITH A CHAIN AS A PROTECTION AGAINST FALLING OR ROLLING.
2. ALWAYS CLOSE CYLINDER VALVE AND REPLACE PROTECTIVE COVERS BEFORE MOVING CYLINDER.
3. KEEP WELDING EQUIPMENT FREE OF OIL AND GREASE.
4. PROTECTIVE GOGGLES AND SPARK-RESISTANT CLOTHING MUST BE WORN WHEN WELDING.
5. MAKE SURE THAT HOSES ARE PROPERLY CONNECTED AND ALL CONNECTIONS ARE TIGHT.
6. KEEP ALL FLAMMABLE MATERIAL AWAY FROM WORKING AREA.
7. DO NOT WELD OR CUT ON A CLOSED CONTAINER WITHOUT INSTRUCTOR'S APPROVAL.
8. THE ACETYLENE MUST NEVER EXCEED 15 PSI OUTLET PRESSURE.
9. ONLY USE A FRICTION TORCH LIGHTER TO IGNITE TORCH.
10. CLOSE ACETYLENE VALVE FIRST IF TORCH BACKFIRES.
11. CLOSE CYLINDER VALVES WHEN COMPLETING A WELDING JOB. RELEASE OR DRAIN HOSES.



NAME _____

DATE _____ GRADE _____

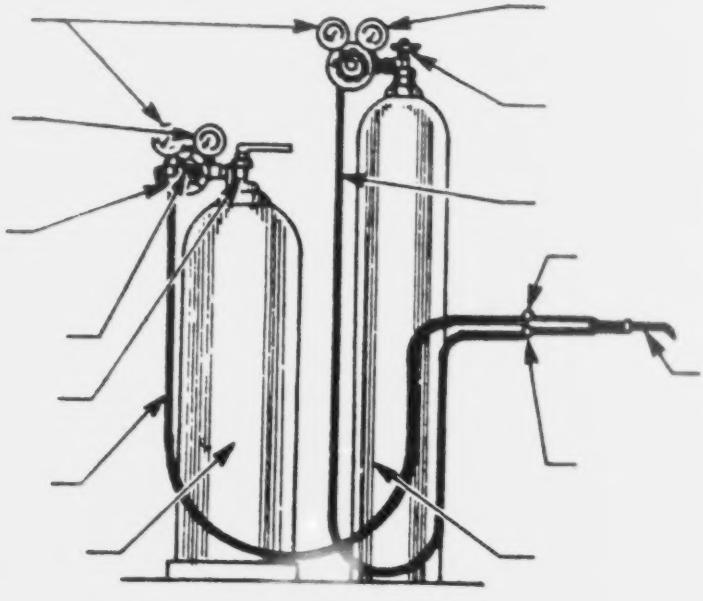
# OxyAcetylene Welder

SAFETY QUIZ

CIRCLE ONE

1. NEVER WEAR SPARK-RESISTANT CLOTHING. T F
2. CLOSED CONTAINERS ARE NOT HAZARDOUS TO WELD OR REPAIR. T F
3. THE CYLINDER CAPS SHOULD BE PLACED ON ALL BOTTLES WHEN NOT IN USE. T F
4. EYE PROTECTION MUST BE WORN FOR ALL WELDING, CUTTING, AND CHIPPING OPERATIONS. T F
5. THE EQUIPMENT SHOULD NOT BE WIPED DOWN WITH OILY RAGS. T F
6. ACETYLENE PRESSURE SHOULD BE SET AT 20PSI. T F

IDENTIFY PARTS



# Tig and Mig Welder

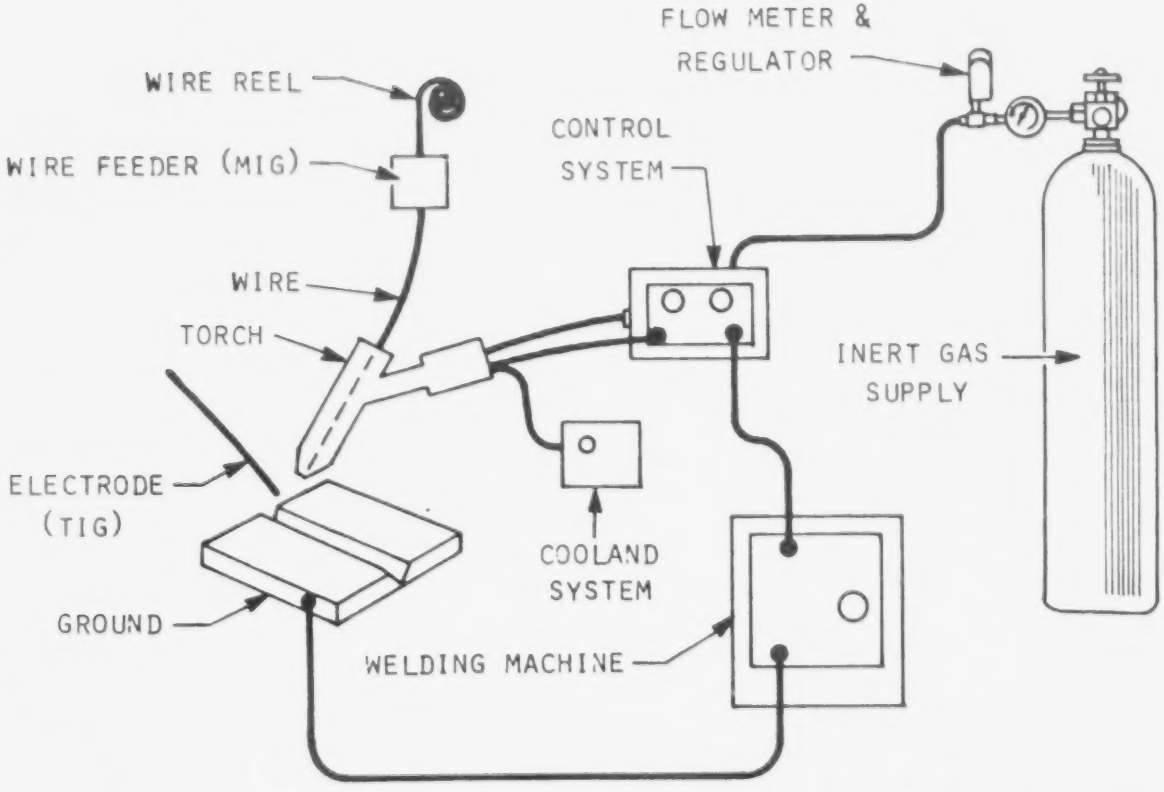
PROPER EYE PROTECTION MUST BE WORN - OPERATE ONLY WITH INSTRUCTOR'S PERMISSION AND AFTER PROPER INSTRUCTIONS HAVE BEEN RECEIVED!

1. ADDITIONAL PROTECTIVE WELDING CLOTHING, INCLUDING A HELMET, LONG SLEEVE JACKET, AND GLOVES MUST BE WORN TO PREVENT BURNS FROM ULTRAVIOLET AND INFRARED RAYS EMITTED WHILE ARC WELDING.

2. THE HELMET USED FOR TIG AND MIG WELDING SHOULD BE EQUIPPED WITH A MINIMUM NUMBER TWELVE DENSITY SHADE.

3. BE CERTAIN THAT THE WELDER EQUIPPED WITH A HIGH FREQUENCY STABILIZING UNIT IS INSTALLED, MAINTAINED, AND USED ACCORDING TO THE RECOMMENDATIONS OF BOTH THE MANUFACTURER AND THE FEDERAL COMMUNICATION COMMISSION.

4. NEVER TOUCH THE TUNGSTEN ELECTRODE OR MIG WIRE WHILE THE WELDER IS TURNED ON. IT IS ELECTRICALLY "HOT" AND CAN CAUSE A SERIOUS SHOCK.




MIG-METAL INERT GAS

TIG- TUNGSTEN INERT GAS

NAME _____

DATE _____ GRADE _____

# Tig and Mig Welder

SAFETY QUIZ

CIRCLE ONE

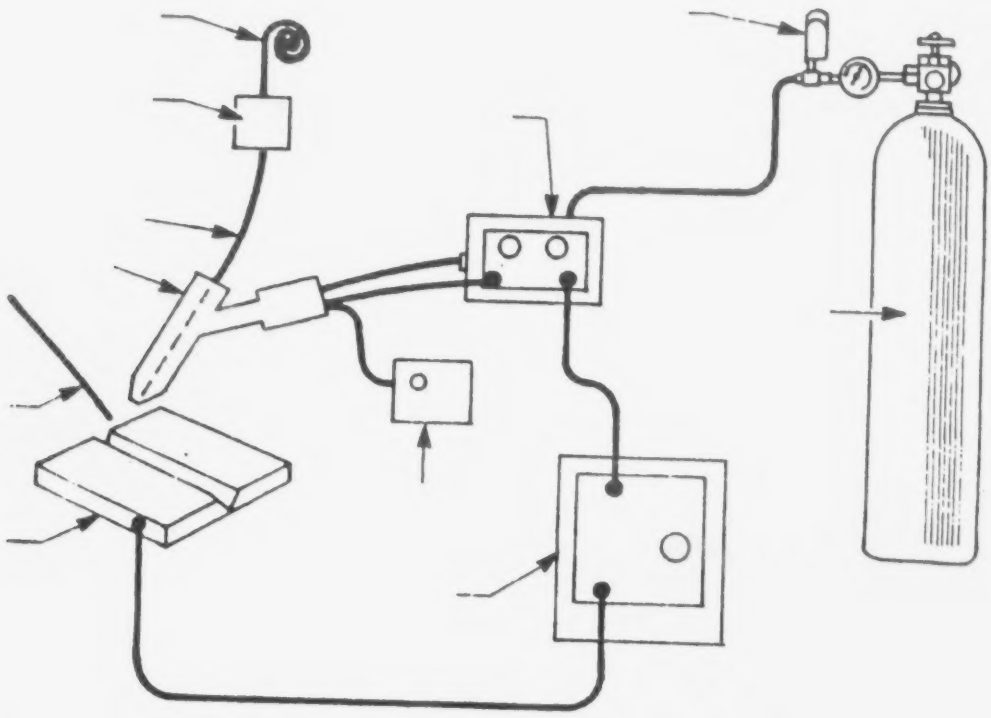
1. IT IS OKAY TO DO TIG OR MIG WELDING WITHOUT A WELDING HELMET. T F

2. YOU CAN BE SHOCKED BY TOUCHING THE TUNGSTEN ELECTRODE WHILE THE TIG WELDER IS TURNED ON. T F

3. THE HIGH FREQUENCY SWITCH MUST BE TURNED OFF WHILE PERFORMING REGULAR ARC WELDING. T F

4. BOTH METAL-ARC WELDING AND GAS-SHIELDED ARC WELDING, GIVE OFF ULTRAVIOLET AND INFRARED RADIATION WHICH CAN BURN UNPROTECTED SKIN. T F

IDENTIFY PARTS



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* Although the National Safety Council is at 444 North Michigan Avenue, Chicago, IL 60611, its directories/catalogs and orders for most of its publications can be placed through the New Jersey State Safety Council, Inc., 50 Park Place, Newark, NJ 07101.

# APPENDICES

APPENDIX A

Pupil Safety and Accident Prevention Requirements

NJAC 6:29-2.3 Care of injured pupils

Board of education shall adopt rules and a program of procedures for the care of pupils injured at school and shall require that such rules and program be explained at the beginning of each school year to all employees and that copies be posted in each school at points conveniently accessible to the personnel.

NJAC 6:20-5.1 Rules and regulations

(a) Every board of education in this State shall adopt rules to govern the supervision of pupil safety in its school district and such rules and regulations shall include as a minimum the rules and regulations of the State Board of Education which are expressed in the following sections.

(b) The safety rules of the board of education and the preventive measures and practices applicable to local conditions shall be explained to the personnel by principals at the beginning of each school year and copies of the rules and procedures shall be posted in schools at points conveniently accessible to the personnel.

NJAC 6:29-5.2 Accident prevention

(a) Principals shall introduce and administer precautionary measures and practices to prevent accidents, panic and fire.

(b) It shall be the duty of each local board of education maintaining courses in health, safety, physical education, practical arts education, and operating a cafeteria or lunchroom, to provide and maintain suitable and safe equipment.

(c) Shop equipment shall not be used for any purpose other than shop instruction. The shop teacher shall be held responsible for the condition of shop tools and equipment, and he shall have full authority for its uses for instructional purposes only.

NJAC 6:43-1.2 Program requirements

(e) It shall be the duty of every board of education maintaining courses in any field of vocational education to provide all equipment, mechanical and electrical, now in service or which may hereafter be placed in service in such courses, with guards or other protective devices which shall neet the safety standards specified in NJAC 6:53-1 et seq.

APPENDIX B

State of New Jersey
DEPARTMENT OF EDUCATION
225 WEST STATE STREET
P. O. BOX 2019
TRENTON, NEW JERSEY 08625

March 1, 1982

TO: Chief School Administrators

SUBJECT: Accident Reporting Forms-MIS 07D007 (NJDE 523-5 Rev. 2/82)

Enclosed please find copies of the revised one page form to be used to report accidents occurring in vocational education courses, programs and/or activities. In accordance with N.J.A.C. 6:53-2.3(a), accidents involving students, teachers or other engaged in vocational education courses, programs and/or activities that require treatment of the victim by a licensed medical doctor shall be reported to the Division of Vocational Education and Career Preparation on the form provided.

Please realize that the term vocational education is all encompassing for the purposes of this report. The vocational education courses, programs and/or activities for which accident reports are to be submitted are specified in part III of the form under the heading "TYPE OF VOCATIONAL COURSE/ PROGRAM/ACTIVITY." Be certain to identify the individual course title where applicable. For example, if an accident occurred in an industrial arts program, identify the course in which it occurred (i.e., auto mechanics, woodworking, metal working, etc.).

The accident report should be completed by the person, usually the instructor, most familiar with the factual circumstances concerning the accident. In addition, the report shall be reviewed and signed by the principal or superintendent of the reporting agency. The completed accident report must be sent to the Division of Vocational Education and Career Preparation within five (5) working days of the occurrence of the accident.

The analysis of the information contained in the accident reports will assist the Division of Vocational Education and Career Preparation staff in planning and organizing educational activities designed to assure safe and healthful learning experiences for all those involved in vocational education.

Continue to use your existing supply of the original 2 page format until it is exhausted.

Thank you for your valued assistance and cooperation in this most important matter.

William Wenzel, Ed.D.
Assistant Commissioner of Education
Division of Vocational Education
and Career Preparation

Enclosure

cc: County Superintendents of Schools

T-202

NJDE 523 5/Rev 3 82

STATE OF NEW JERSEY - DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL EDUCATION AND CAREER PREPARATION
225 WEST STATE STREET - CN 500
TRENTON, NEW JERSEY 08625

MIS070007
Expires 6/30/84

# ACCIDENT REPORTING FORM FOR VOCATIONAL EDUCATION COURSE/PROGRAM/ACTIVITY

I. SCHOOL INFORMATION COUNTY ____ ☐☐ DISTRICT ____ ☐☐☐☐

SCHOOL ____ ☐☐☐☐☐

LOCATION OF ACCIDENT IF OTHER THAN SCHOOL ____

____

II. ACCIDENT INFORMATION

PERSON INJURED ____ SEX: ___M ___F
Last First Middle

GRADE LEVEL____ AGE____ PERSON INJURED ___Student ___Instructor ___Other (Specify)
(Please Check) ____

INJURED PERSON SENT TO ___Hospital ___Physician Date of Accident ____
(Please check) Time of Accident ___A.M. ___P.M.

III. TYPE OF VOCATIONAL COURSE/PROGRAM/ACTIVITY (Please check)

- *___Agriculture/Agribusiness/Natural Resources
- *___Business Education
- *___Cooperative Education
- *___Consumer & Homemaking Education
- *___Distributive Education
- *___Employment Orientation
- *___Health Occupations
- *___Home Economics Related Occupations
- *___Introduction to Vocations
- *___Industrial Arts
- *___Technical Education
- *___Technology for Children
- *___Vocational-Industrial Education
- *___Work Study
- *___WECEP
- *___Vocational Student Organizations
- *___Other ____

*Specify title of course/program/activity ____ (SDE USE ONLY) ☐☐☐☐☐☐☐

## COOPERATIVE VOCATIONAL EDUCATION ACCIDENTS ONLY

Student's Job Title ____ Work Station Approval Number ____

Was Student Covered By ___Working Papers ___Training Agreement ___Worker's Compensation
(CHECK ALL THAT APPLY)

IV. DESCRIPTION OF INJURY

1. PART OF BODY INJURED (Please Check)

| | | |
|---|---|---|
| __Abdomen | __Eye | __Nose |
| __Ankle | __Face | __Ribs |
| __Arm | __Finger | __Scalp |
| __Back | __Foot | __Stomach |
| __Buttocks | __Hand | __Throat |
| __Chest | __Knee | __Teeth |
| __Collar-Bone | __Leg | __Wrist |
| __Ear | __Mouth | __*Other |
| __Elbow | __Neck | |

*SPECIFY ____

2. APPARENT NATURE OF INJURY (Please Check)

| | |
|---|---|
| __Abrasion | __Fracture |
| __Amputation | __Poisoning |
| __Asphyxiation | __Puncture |
| __Bite | __Scalding |
| __Bruise | __Scratches |
| __Bump | __Shock (electric) |
| __Burn | __Splinter |
| __Concussion | __Sprain |
| __Cut-Laceration | __Sting |
| __Dislocation | __*Other |

*SPECIFY ____

3. CAUSE OF INJURY (Please Check)

| | |
|---|---|
| __Struck Against | __Overexertion |
| __Struck By | __Contact with Electric Current |
| __Fall from Elevation | __Contact with Caustic, Toxic, Noxious Substance |
| __Fall from Same Level | __Contact with Temperature Extremes |
| __Caught In, Under, Between | |
| __Rubbed or Abraded | |

__Other (Specify) ____

4. DEGREE OF INJURY (Please Check)

- ___Non-Disabling
- ___Temporary Disability
- ___Permanent Disability
- ___Death

V. NARRATIVE (Briefly describe how accident occurred indicating conditions, actions, tools and equipment involved.) ____

ACCIDENT REPORT COMPLETED BY

Name ____
Title ____
Telephone Number ____

*Signature of Principal or Superintendent

____
Date ____

APPENDIX C

Facility Safety Requirements

NJAC 6:22-4.5 Emergency cut-out switches

There shall be push type emergency cut-out switches provided at appropriate locations within shops to de-energize the electrical supply to machinery. These switches shall be provided on the basis of one for each 1,000 square feet or fraction thereof of floor area in the shop, but not less than two. Reset of the interrupted service shall be by a key-operated switch. The cut-out and reset circuits shall be designed and installed to negate the possibility of the control circuit being de-energized thereby being inoperative.

NJAC 6:22-4.6 Magnetic-type switches

All non-portable motorized equipment and machinery shall be provided with magnetic-type switches to prevent machines from automatically re-starting upon restoration of power after an electrical failure or activation of the above emergency cut-off.

NJAC 6:22-4.7 Gas shut-off switches

The line supplying gas to each instructional room, laboratory, shop or other space where gas is used by students, except home economics areas, shall be provided with an electric solenoid key-operated gas shut-off switch.

NJAC 6:22-2.2 (j) 5i A check valve shall be installed in the line supplying gas to each classroom, laboratory, shop or other area where gas is used by students, except home economics rooms.

APPENDIX D

Exhaust and Ventilation Information

NJAC 6:22-5.2 Minimum ventilation requirements

(a) All school buildings shall be equipped with a mechanical air supply and exhaust ventilation system which will provide, during periods of occupancy, standard tempered outdoor air supply, mechanical exhaust and system capacities at the minimum rates set forth . . .

NJAC 6:22-5.2 (b) 3 Special exhaust systems shall be provided for removal of dust, fumes, odors and excessive heat in all areas such as shops, kitchens, dishwashing rooms, home economics cooking rooms, paint finishing rooms, paint finishing booths, cosmetology classrooms, science laboratories and science prep rooms. Provisions shall be made for introducing tempered make-up air to satisfy exhaust system requirements. Make-up air may be drawn from corridor ceiling plenums. The systems shall be manually controlled and energized when required. Exhaust systems shall have capacities 10 per cent in excess of air make-up systems. Rooms accommodating internal combustion engines shall be provided with adequate air intake and exhaust facilities to suit engine requirements and engine exhaust shall be piped to the exterior of the building.

NJAC 6:22-5.2 (b) 15 Each shop, where dust generating equipment is installed, shall be provided with dust collecting equipment. Such equipment shall be either single or multi-use vacuum packs or a central dust collection system. Installed systems shall comply with National Fire Protection Association Standard No. 91, and New Jersey Department of Environmental Protection regulations (N.J.A.C. 7:27-8.1 et seq.).

NJAC 6:22-5.3 (b) 16 Exhaust hoods and flues for ranges, forges or other heat generating equipment when installed shall be in compliance with National Fire Protection Association Standard No. 96, and of the 1978 BOCA Basic Mechanical Code, Section M-321.0.

## APPENDIX E

### Fire Extinguisher Requirements

NJAC 6:22-2.2 (1) 15i Fire extinguishers shall be dry chemical type suitable for use on Class A, B and C fires (multi-purpose). Extinguishers shall carry a rating of at least 2A in addition to its class B and C ratings.

NJAC 6:22-2.2 (1) 15iv For hazardous locations, including but not restricted to shops, science laboratories, stages, faculty rooms, home economics rooms, kitchens, garages and heater rooms, at least one 10BC rated extinguisher shall be provided. These shall be in addition to those required in corridors.

NJAC 6:22-2.2 (1) 15vi The owner or occupant of a property in which portable fire extinguishers are located shall be responsible for the inspection, maintenance and recharging of such equipment in accordance with National Fire Protection Association Standard No. 10 (1978).

APPENDIX F

STATE OF NEW JERSEY, DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL EDUCATION AND CAREER PREPARATION
225 West State Street, Trenton, NJ 08625

RECOMMENDED FACILITY CAPACITIES

| Type of Facility | Total Square Feet | Areas | | | |
|---|---|---|---|---|---|
| | | Instruction | Planning | Finishing | Storage |
| HIGH SCHOOL | | | | | |
| Comprehensive General | 3,400 | 2,800 | 150 | 150 | 300 |
| Drafting (24 students) | 1,350 | 1,200 | - | - | 150 |
| Electricity/Electronics | 2,250 | 1,800 | 200[a] | - | 250 |
| General Metals | 2,850 | 2,400 | 150 | - | 300 |
| Graphic Arts | 2,850 | 2,400 | 200[b] | - | 250 |
| Power - Automotive | 3,200 | 2,800 | - | - | 400 |
| Wood | 2,950 | 2,400 | - | 150 | 400 |
| JUNIOR HIGH/MIDDLE SCHOOL | | | | | |
| Comprehensive General | 2,800 | 2,300 | - | 150 | 350 |
| Drafting (24 students) | 1,150 | 1,000 | - | - | 150 |
| General Metals | 2,100 | 1,800 | - | - | 300 |
| General Wood | 2,250 | 1,800 | - | 150 | 300 |
| World of Construction | 2,500 | 2,250 | - | - | 250 |
| World of Manufacturing | 2,250 | 2,000 | - | - | 250 |
| ELEMENTARY SCHOOL K-6 | | | | | |
| Comprehensive General | 2,000 | 1,600 | - | 150 | 250 |

Note: Maximum student capacity = 20 (except for Drafting).

[a]Radio shack alignment room.

[b]Darkroom.

APPENDIX G

## Eye Protection Requirements

N.J.S.A. 18A:40-12.1. Protective eye devices required for teachers, pupils and visitors in certain cases.

The board of education of every school district shall require each pupil and teacher in the public schools of the district to wear industrial quality eye protective devices while attending classes invocational or industrial arts shops or laboratories in which caustic or explosive chemicals, hot liquids or solids, hot molten metals, or explosives are used or in which welding of any type, repair or servicing of vehicles, heat treatment or tempering of metals, or the milling, sawing, stamping or cutting of solid materials, or any similar dangerous process is taught, exposure to which might have a tendency to cause damage to the eyes. Visitors to such classrooms or laboratories shall also be required to wear such protective devices.

N.J.S.A. 18A:40-12.2. Rules prescribing kinds, types and quality of devices.

The commissioner, by rule or regulation, shall prescribe the kinds, types and quality of such protective devices and in so doing, the commissioner shall be guided by the standards promulgated by the American Standards Association, Inc. for such protective devices. (ASAI now known as American National Standards Institute (ANSI).)

N.J.A.C. 6:3-1.14. Use of eye protective devices in public schools

(a) The board of education of every school district shall require each pupil and teacher in the public schools of the district to wear industrial quality eye protective devices while attending classes in vocational or industrial arts shops or laboratories in which caustic or explosive chemicals, hot liquids or solids, hot molten metals, or explosives are used or in which welding of any type, repair or servicing of vehicles, heat treatment or tempering of metals, or the milling, sawing, stamping or cutting of solid materials, or any similar dangerous process is taught, exposure to which might have a tendency to cause damage to the eyes. Visitors to such classrooms or laboratories shall also be required to wear such protective devices.

(b) The term "eye protective devices" as the law provides, shall not be limited to white or tinted, plano lenses, but may include safety glasses ground to prescription. It shall not include prescription lenses of ordinary glass.

(c) The kind and type of eye protective devices utilized are as follows:

1. Spectacles - with side shields - clear or colored;

2. Goggles - clear, colored or splash type;

3. Shields - clear or colored;

4. Welding helmets;

5. Hoods - very special operations.

(d) The following types of protective devices shall be used to fit the designated activities and shall meet or exceed standards promulgated by the American Standards Association Incorporated (approved, November 27, 1959)* and/or the prescribed government specifications for such devices:

| | Potential Eye Hazard | Type of Protective Needed |
|---|---|---|
| 1. | Caustic or explosive chemicals | Clear goggles, splash |
| 2. | Explosives (solids or gases) | Clear goggles |
| 3. | Dust producing operations | Clear goggles, splash proof |
| 4. | Electric arc welding | Welding helmet |
| 5. | Oxy-acetylene welding | Colored goggles or welding helmet |
| 6. | Hot liquids and gases | Clear goggles, splash proof |
| 7. | Hot solids | Clear or colored goggles or spectacles |
| 8. | Hot molten metals | Clear or colored goggles |
| 9. | Heat treatment or tempering of metals | Colored or clear spectacles or goggles |
| 10. | Glare operations | Colored spectacles or goggles or welding helmet |
| 11. | Shaping of solid materials: chipping, cutting, grinding, milling, sawing, stamping | Clear goggles or spectacles |

| | | |
|---|---|---|
| 12. | Repair or servicing vehicles | Clear goggles or spectacles |
| 13. | Any other similar activity being conducted in the instructional program where exposure might have a tendency to cause damage to the eyes requires the use of proper eye protective devices. | |

(e) The following safeguards shall be used:

1. The board of education of every school district shall establish and implement a specific eye protective program in the public schools of the district in compliance with this law.

2. No pupil, teacher or visitor shall be subjected to any hazardous environmental condition without proper eye protection.

3. An adequate inspection program shall be developed to detect eye hazards.

4. All eye protective devices shall be examined to see that each is functional.

5. Materials used in eye protectors shall be nonirritating to the skin.

6. Any shared eye protective device shall be disinfected by the method prescribed by the local school medical inspector.

7. All spectacles or goggles must have impact resistant lenses. Wherever possible, lenses should have a six base curve, not flat lenses. All spectacles must have side shields.

8. Students wearing corrective lenses shall be required to wear impact resistant cover-all glasses or devices, or the proper type of plastic cover alls.

*American Standards Association, Inc. now known as the American National Standards Institute. Current eye safety requirements contained in ANSI Z87.1-1979.

## Selection Chart for Eye and Face Protectors for Use in Industry, Schools, and Colleges

This Selection Chart offers general recommendations only. Final selection of eye and face protective devices is the responsibility of management and safety specialists. (For laser protection, refer to American National Standard for Safe Use of Lasers, ANSI Z136.1-1976.)

1. GOGGLES, Flexible Fitting, Regular Ventilation
2. GOGGLES, Flexible Fitting, Hooded Ventilation
3. GOGGLES, Cushioned Fitting, Rigid Body
4. SPECTACLES, without Sideshields
5. SPECTACLES, Eyecup Type Sideshields
6. SPECTACLES, Semi-/Flat-Fold Sideshields
7. WELDING GOGGLES, Eyecup Type, Tinted Lenses (Illustrated)
7A. CHIPPING GOGGLES, Eyecup Type, Clear Safety Lenses (Not Illustrated)
8. WELDING GOGGLES, Coverspec Type, Tinted Lenses (Illustrated)
8A. CHIPPING GOGGLES, Coverspec Type, Clear Safety Lenses (Not Illustrated)
9. WELDING GOGGLES, Coverspec Type, Tinted Plate Lens
10. FACE SHIELD, Plastic or Mesh Window (see caution note)
11. WELDING HELMET

| APPLICATIONS | | |
|---|---|---|
| OPERATION | HAZARDS | PROTECTORS |
| ACETYLENE–BURNING<br>ACETYLENE–CUTTING<br>ACETYLENE–WELDING | SPARKS, HARMFUL RAYS, MOLTEN METAL, FLYING PARTICLES | 7, 8, 9 |
| CHEMICAL HANDLING | SPLASH, ACID BURNS, FUMES | 2 (For severe exposure add 10) |
| CHIPPING | FLYING PARTICLES | 1, 3, 4, 5, 6, 7A, 8A |
| ELECTRIC (ARC) WELDING | SPARKS, INTENSE RAYS, MOLTEN METAL | 11 (In combination with 4, 5, 6, in tinted lenses, advisable) |
| FURNACE OPERATIONS | GLARE, HEAT, MOLTEN METAL | 7, 8, 9 (For severe exposure add 10) |
| GRINDING–LIGHT | FLYING PARTICLES | 1, 3, 5, 6 (For severe exposure add 10) |
| GRINDING–HEAVY | FLYING PARTICLES | 1, 3, 7A, 8A (For severe exposure add 10) |
| LABORATORY | CHEMICAL SPLASH, GLASS BREAKAGE | 2 (10 when in combination with 5, 6) |
| MACHINING | FLYING PARTICLES | 1, 3, 5, 6 (For severe exposure add 10) |
| MOLTEN METALS | HEAT, GLARE, SPARKS, SPLASH | 7, 8 (10 in combination with 5, 6, in tinted lenses) |
| SPOT WELDING | FLYING PARTICLES, SPARKS | 1, 3, 4, 5, 6 (Tinted lenses advisable; for severe exposure add 10) |

APPENDIX I

SAFETY TEST

Hy Kaliber Regional High School Student _____

Department of Industrial Arts Education Date _____

Shop _____ Room _____ Teacher _____

TRUE & FALSE: Circle correct letter (T or F).

1. Eye protective devices are necessary when working on metal cutting machines. T F
2. All adjustments to blades, cutters, etc., should be made before turning on the machine. T F
3. The machine will cut stock as fast as you can feed it. T F
4. Avoid talking to someone operating a machine. T F
5. It is okay to leave a machine running if you are going to be just a few feet away. T F
6. If a machine is not working properly, leave it for the next person to worry about. T F
7. Think through an operation before performing. T F
8. Keep machine tables clear of tools, stock, and other project materials. T F
9. Use compressed air to clean off machines. T F
10. Hands should be kept at least 4 inches from the cutting tool. T F
11. Throw oily rags in the wastebasket immediately after using. T F
12. Do not use machines for trivial operations. T F
13. Any liquid spilled on the floor should be wiped up immediately because it causes more work for the custodian. T F
14. If you notice any breakage or damage to a tool, instrument, or machine, you should notify your instructor. T F
15. You should wear suitable eye protection to improve your vision. T F

MULTIPLE CHOICE: Place letter of correct statement in the space provided for each answer.

1. It is necessary to secure the teacher's permission to operate power equipment because: ( )
   a. the teacher wants only certain students to operate the machines.
   b. it may not be the proper machine to use.
   c. a machine should not be operated until instructions in its use have been given.
   d. it needs to be checked and oiled.

2. Properly fitted clothing (rolled-up or buttoned-up sleeves, tucked-in or no ties, and tucked-in shirt tails) should be worn while working in a shop because: ( )
   a. loose clothing is a safety hazard.
   b. it looks attractive if all students dress alike.
   c. shop students should be dressed differently than other students.
   d. proper clothing is less expensive than ill-fitted clothing.

3. Tools should be carefully put away at the end of the period because: ( )
   a. there is always enough time to procrastinate.
   b. they need to be put where other students can find them when needed.
   c. that is what is expected of a worker in industry.
   d. school's principal may make an unscheduled inspection.

4. Horseplay is not permitted in the shop because: ( )
   a. there is not enough room for play. (A gymnasium is to play in.)
   b. one may injure oneself and/or someone else.
   c. tools may be broken.
   d. it prevents other students from working.

5. When working in a shop, students should dress carefully because: ( )
   a. visitors like to see well-dressed workers.
   b. good clothes are apt to be torn.
   c. improper clothing is dangerous.
   d. a neat dresser does better work.

6. All injuries should be reported to the teacher: ( )
   a. so that an accident report can be filed.
   b. so the hazard may be eliminated.
   c. in order to get first aid or be taken to the doctor.
   d. so the cause of the accident may be known.

7. Students should be especially alert to danger from accidents: ( )
   a. when using unfamiliar tools.
   b. when trying to hurry to complete some project.
   c. when the instructor is out of the room.
   d. when assisting the instructor.

8. If students are not sure about the operation of a certain piece of equipment, they should: ( )
   a. if possible, learn about it from the manual for that equipment.
   b. be checked out on it by the instructor.
   c. ask a student who has used it to help them.
   d. try it out on a piece of scrap material.

9. In all shop work, the most important consideration for the students should be: ( )
   a. speed of production.
   b. accuracy in their work.
   c. safety for themselves and others.
   d. conservation of supplies.

10. School shop accidents can never be entirely eliminated because: ( )
   a. fool-proof guards cannot be made for machines.
   b. machinery breaks and causes injuries very often.
   c. operators of tools and machines are careless.
   d. of all of the above reasons.

11. Machines should be cleaned after use with: ( )
   a. a brush.
   b. a hand.
   c. a rag.
   d. none of these items.

12. The work area should be kept: ( )
   a. cluttered.
   b. clean.
   c. dirty.
   d. in none of these conditions.

13. Scrap should be placed: ( )
   a. on the corner of the work table.
   b. in provided container.
   c. on the floor near work area.
   d. in none of these places.

14. Tools should always be: ( )
   a. left on benches.
   b. left on machines.
   c. put away when not in use.
   d. placed in storage room.

15. Material which is unquestionably scrap: ( )
   a. should be stored until the end of the year.
   b. should be removed from the shop each period and stored for future use.
   c. should be placed in scrap boxes and disposed of as necessary.
   d. should be traded for usable material.

16. When handling materials, students should be sure to: ( )
   a. use available mechanical equipment.
   b. wear gloves and safety shoes.
   c. handle them in such a way that they will not strike someone.
   d. do all of these actions.

17. When the instructor is out of the room: ( )
   a. machines should not be operated.
   b. it is alright to operate special machines.
   c. it is a good time to experiment with a machine.
   d. none of these things should be done.

18. Wear proper goggles, face shields, aprons, and other personal protective equipment: ( )
    a. only when the instructor is in the room.
    b. on jobs which require them.
    c. only when made to do so.
    d. under all of these conditions.

19. When using a machine for a small or quick job: ( )
    a. it is not necessary to put on protective equipment.
    b. take the time to put on protective equipment.
    c. one can rely on machine guards for adequate protection.
    d. none of these conditions are proper.

20. If an object is too heavy or awkward: ( )
    a. get help.
    b. show off by lifting it alone.
    c. take a chance that the load won't drop or fall on someone.
    d. do none of these acts.

COMPLETION: Complete each sentence by filling in the blank space. Place the word(s) in the space provided for each answer.

1. Dry chips should be cleared away with a piece of wood or a __(1)__. 1 _____

2. Tools are passed to classmates or co-workers with the handles __(2)__. 2 _____

3. Work being drilled on the drill press should be securely clamped to the table or in a __(3)__. 3 _____

4. You must wear a face shield or safety glasses (goggles, spectacles) when using a grinder because it will protect your __(4)__. 4 _____

5. Flammable liquids should be stored in a room or cabinet that is __(5)__. 5 _____

6. Rags containing oil, gasoline, paint, solvents, or other combustibles should be placed in __(6)__. 6 _____

7. Necessary adjustments are made to power tools and equipment when the power source is __(7)__. 7 _____

8. When using a wood chisel, the sharp edge of the tool should be pointed away from classmates, instructor, and __(8)__. 8 _____

9. All injuries, even though slight, should be reported to the __(9)__. 9 _____

10. To feed a narrow piece of stock through a circular saw, the operator should use an approved __(10)__. 10 _____

Notes to the Test Developer (the Instructor)

There are a few rules to which one should adhere in order to construct a test that will indicate whether the students "know" the information, that has been considered by the instructor to be important, and can carry out the "performances," considered by the trade, industry, and/or community to be important, to verify that the students possess some competency in the subject area.

A paper-and-pencil test, the usual method, can consist of generally short-answer questions: true and false questions, one word or short phrase questions (sometimes referred to as unstructured format questions), multiple choice questions, completion questions, identification questions, and matching questions.

True and False questions should avoid such words as: only, never, sometimes, always, all, etc. The answers need not be patterned with half true, half false, or with a repeated set number of true then a set of false answers. (Fifty percent or less correct T & F answers should be considered as the lowest score.)

One Word or Short-Phrase questions (unstructured format) are questions that generally begin with: who, what, when, which, where, etc., and seek specific one word or short-phrase answers. (Developers of questions should consider comments under Completion questions.)

Multiple Choice questions, preferred by psychologists, should have five choices, and no less than four choices, if they are to be effective. The instructor must be aware that all but one of the answers may reinforce a wrong idea. Therefore, the questions must be carefully constructed. A smattering of such phrases as "all of the above," "none of the above," "only a and c," etc., may be in order. Also, the question's statement and completing phrases should be in grammatically proper sentences. Negative sentences should be avoided.

Completion questions should avoid use of answers that require words or phrases that have more than one possible answer, unless "all" answers will be acceptable. (i.e., white gas - unleaded gas, jig saw - scroll saw, teacher - instructor, shut off - disconnected, etc.) Answers which are subject to grammatical hints by following an indefinite article (a, an) should be avoided. If more than one word is expected for the answer, it is preferable not to supply two or more lines for the answer. Under no circumstances, if more than one line is used, should a line be short - to indicate a short word answer - while another line is long - to indicate a long word answer.

Identification questions (samples may be found in section on Equipment Instruction Sheets and Evaluations) should have a very limited number of items to be named. The arrows must be carefully and distinctly drawn to indicate the exact item in question. Identity should be limited to parts that are absolutely essential for the operator to know.

Matching questions should have at least two more solutions than there are words or phrases to be matched. One column of the words and/or phrases is to be lettered and the other numbered.

Essay questions can also be paper-and-pencil questions, but they should be questions that reflect how the students feel about a certain topic. If the instructor expects a specific set of answers, the "list and explain the reasons" kind of answers, it is questionable whether the regurgitated, memorized answers constitute the reply to an essay question.

Cognitive questions and answers may (?) give some clues as to whether the students "know" some safety-related items, but it is really the safety attitude that instructors should seek. "None" of the previously mentioned paper-and-pencil questions will draw responses which tell the instructor that the student will do what should be done. The instructor, therefore, should ask some attitudinal questions. For example (an essay, case history, question):

1. While the instructor is helping a student, you see another student in the process of using a tool incorrectly. What should (would) you do?

Although there may not be one correct answer, it should provide for a meaningful discussion and, maybe, just maybe, the students will begin to develop a safety attitude.

In conclusion: catch or trick questions are to be avoided, no matter what type of question is used; each question should deal with a single subject; and sufficient time should be provided for completing the test, examination, quiz, or evaluation.

While 70 percent may be the school's minimum passing grade, it is disputable whether that should be acceptable on a safety test. It would seem to indicate that any 30 percent of the items are not important, or that causing/receiving three accidents in 10 attempts to perform a task is acceptable, or that a nurse can inject only 7 out of 10 needles correctly in order to be considered an effective nurse. It is strongly recommended that a perfect score, 100 percent, be required for passing a safety test. (Mostly passed is like slightly pregnant - it doesn't make sense.)

APPENDIX J

INDUSTRIAL ARTS EDUCATION

SCHOOL SAFETY INSPECTION CHECK LIST

School _____ Date _____

Laboratory _____

Instructor _____

Inspection Team _____

Purpose

A safe environment is an essential part of the industrial arts education program. The safe environment will exist only if hazardous conditions are discovered and corrected through regular and frequent inspections by school personnel (administrators, safety committees, teachers, and students). Safety inspections are to ascertain if conditions are satisfactory.

A safety inspection check list for industrial arts education is an objective tool for helping improve conditions in the working area. A safety check list can aid in:

1. informing, educating, and reminding people of what to look at.
2. training personnel to be observant and aware of their environment.
3. providing a source of feedback information to teachers and administrators which will allow them to ascertain effectiveness of their safety education program and training activities.
4. providing a record of safety items and safety activity.

General Instructions for Use of the Check List

It is recommended that:

1. A safety committee should complete the check list for each industrial arts laboratory.
2. The inspection team may arrange for additional assistance from outside agencies for the regular safety inspections.
3. As a minimum, safety inspections should be made at the beginning of every school term or semester. More frequent inspections are advisable.
4. Inspections should be planned in advance, preferably for times when students will be using the facility.
5. The current inspection report should be compared with previous reports and records to ascertain progress. The report should be studied in terms of accident prevention so that special attention can be given to those conditions and locations which are potential accident producers.

6. In all cases where unsatisfactory conditions are indicated, it is important that corrective actions be requested, in writing, from the proper authorities. (Unsafe machines and equipment are to be removed from service until the problems are remedied.)

7. A conference of the safety committee and the teacher should be held shortly following the inspection.

8. Four copies of the completed check list and recommendations should be filed: one each for the administrator, department chairperson or supervisor, safety committee, and teacher.

Directions for Completing the Check List

Draw a circle around the appropriate letter (S, U, NA). Respond to all items.

S = Satisfactory (needs no attention)

U = Unsatisfactory (needs immediate attention)

NA = Not applicable

Recommendations should be made, in all cases, where a "U" is circled. Space is provided at the end of the form for such comments. (Add additional sheets if more space is needed.) Designate the items referred to in the recommendations by using the applicable section letter and number (e.g., B-2).

A. SCHOOL ADMINISTRATION

1. The school principal (or another administrator) visits all laboratories to check for hazardous conditions to make provisions for corrections. . . . . S U NA

2. The school principal requires that standardized written reports on hazardous conditions be submitted and distributed to the proper individuals to assure corrective actions . . . . . S U NA

3. A written procedure has been established for reporting defective equipment immediately to assure prompt repair . . . . . S U NA

4. The school principal keeps records of all inspectiona, and those records are readily available for reference S U NA

5. The school district has defined "an accident" and has available employee and student accident reporting forms which fulfill the State statistical requirements. . . . . S U NA

6. All accidents are promptly reported and analyzed. . . . S U NA

7. Immediate steps are taken to correct causes of accidents, and copies of all reports are kept in a school file until it is determined they are no longer necessary. . . . . S U NA

8. The school has readily available all necessary information in order to reach parents or guardians in case of emergency. . . . . S U NA

9. The school has an effective standardized district safety education program . . . . S U NA

10. The school has a policy and procedure for the administration of first aid. . . . . S U NA

11. The school has an effective policy and procedure to follow in case an accident occurs . . . . . S U NA

12. The instructor is notified of all student disabilities (physical and mental). . . . S U NA

13. The instructor has direct communication with the school nurse, and outside telephone lines are available . . . . . S U NA

14. First-aid personnel or a nurse is abailable at all times. . . . . S U NA

15. The school principal accepts the responsibility for keeping class sizes appropriate for activities, student age, facility size, and the number of work stations available. . . . . S U NA

16. The school principal is aware of his/her responsibility and liability in regard to students' protection . . . . . S U NA

17. The school principal requires that the shop areas be maintained and cleaned, and provided with the same custodial services available to other general education programs . . . . . S U NA

18. The school principal makes sure that an industrial arts certified instructor is in attendance when student work takes place. . . . . S U NA

19. A policy exists for dealing with the removal of students who consistently violate safety regulations . . . . . S U NA

**********

B. INSTRUCTOR

1. Industrial arts teacher supervision is provided at all times when classes are in session . . . . . S U NA

2. The instructor continuously inspects the facility to check on needed repairs and corrections. . . . . S U NA

3. The instructor utilizes an inspection check list when making formal inspections. . S U NA

4. The instructor reports all hazardous conditions to the proper administrators. . . . S U NA

5. The instructor keeps records of all inspections and has copies of inspection reports readily available for reference. . . . . S U NA

6. The instructor keeps records of all maintenance problems and the disposition of requests for corrections . . . S U NA

7. The instructor keeps records of all accidents, and analyzes them immediately for corrective measures. . . . . S U NA

8. The instructor keeps records of all safety instruction and evaluation . . . . . S U NA

9. Instructor-owned tools are not used by students unless a district policy has been established to cover their use, and the school principal has been informed. . . . S U NA

10. The instructor selects students' activities, keeping in mind the maturation level and ability of the students involved . . . . . S U NA

11. The instructor makes sure that students wear approved protective equipment . . . . S U NA

12. The instructor makes sure that students wear eye protective devices at all times in a laboratory . . . . . S U NA

13. The instructor is responsible to see that personal protective devices have been sterilized S U NA

14. Instruction is reinforced by continuous proper example of the instructor, such as wearing approved protective equipment. . . . . S U NA

15. The instructor is knowledgeable in the use of the various fire extinguishers in the facility S U NA

16. The instructor makes sure that all machines are locked out and tagged properly. . . . . S U NA

17. A system for handling hot materials has been established S U NA

18. When classes are not in session, the instructor makes sure that main power switches are in the "off" position. . S U NA

19. Routine preventive maintenance is practiced to prevent breakdown of equipment and assure safe operation . . . . . S U NA

C. INSTRUCTION

1. The students' sense of responsibility is promoted, developed, and periodically evaluated . . . . . S U NA

2. Students receive instruction in the use of all tools and equipment before permission to operate equipment is given . . . . . S U NA

3. Students are tested (written and performance) and permission is granted before machines are operated . . . S U NA

4. Consistent rules are established and enforced for safe, efficient shop operation. . S U NA

5. Students are instructed and alerted to possible hazardous operations and are monitored in these activities . S U NA

6. "Horseplay" and practical jokes are not tolerated . . S U NA

7. Proper instructions and warnings are given in the use and handling of toxic, caustic, and volatile materials . . . . . S U NA

8. In order to provide continuous safety instruction, safety is included in all phases of the instructional program . . . . . S U NA

9. Students are instructed in the proper methods of handling, lifting, and moving materials . . . . . S U NA

10. Students are instructed to stay clear of others operating machines. . . . . S U NA

11. All work undertaken is approved by the instructor through an established procedure. . . . . S U NA

12. Materials being worked are secured when the operation being conducted so demands. S U NA

13. A class personnel organization, including a student safety engineer, is used. . S U NA

14. Safety bulletin boards, posters, and student reports are part of the total safety program. . . . S U NA

15. Students are instructed in methods of reporting hazards and fires . . . . . S U NA

**********

D. PERSONNEL PROTECTION

1. In compliance with New Jersey laws, approved eye protection devices are worn and appropriate signs posted. . S U NA

2. Emergency eyewash devices are available when using caustic materials . . . . . S U NA

3. After use, eye protective devices are cleaned and returned to properly designed storage racks. . . . S U NA

4. In all areas needing special body protective clothing (aprons, shoes, gloves), the clothing is provided and used. . . . . S U NA

5. In all areas needing respiratory devices, the devices are provided and used . . . S U NA

6. In all areas needing noise suppression devices, the devices are provided and used . . . . . S U NA

7. Regulations in regard to the use of loose clothing, jewelry, ties, long hair, etc., are enforced . . . . S U NA

8. All injuries are reported to the instructor for immediate attention. . . . . S U NA

**********

E. GENERAL FACILITY

1. One instructor has the overall responsibility for each major laboratory facility . S U NA

2. Each major shop facility can be locked separately. . . . S U NA

3. Provision has been made for keeping inappropriate garments and other materials out of activity areas . . . S U NA

4. Good housekeeping standards are observed. . . . . S U NA

5. The student instruction-related cleamup program is supported daily with complete custodial services . S U NA

6. Waste (shavings, sawdust, paint, and oily rags) is collected daily and disposed of by the custodian . S U NA

7. Floors are maintained in a condition conducive to safe practices with nonskid surfaces provided at machine operation stations. . . . . S U NA

8. Designated safety zones are provided around all stationary machines and other dangerous work areas. . . . . S U NA

9. Aisles are clear of protruding materials . . . . . S U NA

10. Room furniture and equipment are arranged for optimum safety . . . . . S U NA

11. Nonglare lighting is provided for all work areas . . . . S U NA

12. Stairways within existing laboratories have safe treads, rise with unobstructed access, and have approved railings S U NA

13. Railings and treads are color-coded. . . . . S U NA

14. Two widely-separated, marked exits are available from each major laboratory area over 2000 square feet in size . . . . . S U NA

15. Facilities are light, pleasant, dlean, and conducive to good instruction . . . . . S U NA

16. Machine operation regulations and safety procedures are posted conspicuously near areas of operation . . . . . S U NA

17. Parts of machines and equipment needing special attention or caution are painted brightly with correct color code . . . . . S U NA

18. Machine and work stations are located in relationship to the amount of supervision required . . . . . S U NA

19. Machine location has been determined by needed operator space requirements and process compatibility . S U NA

20. Health hazards are considered in facility design to minimize injuries from excess heat, noise, fire, fumes, and dusty conditions S U NA

**********

F. STORAGE

1. Storage racks and shelves are designed and constructed to meet storage needs . S U NA

2. Materials are stored in a safe manner . . . . . S U NA

3. Students and instructors are protected from protruding materials and sharp edges . . . . . S U NA

4. All flammable and combustible liquids, toxics, and caustics are stored securely in proper containers, and are identified by name and degree of hazard . . . . . S U NA

5. Approved storage cabinets are provided for all flammable and combustible liquids . . . . . S U NA

6. Provision has been made for an approved bulk storage area . . . . . S U NA

**********

G. ELECTRICAL

1. All electrical wiring is installed and maintained in accordance with National Electrical Code.

   a. Switches are enclosed . S U NA

   b. Circuits are identified . . . . . S U NA

   c. All power cords are of proper length as determined by guage and load S U NA

   d. Power supplies are provided with overload protection . . . . . S U NA

   e. Lockouts are provided S U NA

2. All outlets and machines are grounded . . . . . S U NA

3. All extension cords are three-wire with proper connections . . . . . S U NA

4. All portable power tools are provided with three-prong plugs, except those which are double-insulated . . . . S U NA

5. Readily accessible individual "off" and "on" controls are installed on all machines as well as in the room power-control panel . . S U NA

6. On machines where injury might result if motors were to restart after major power shutoff, provision is made to prevent such restarting (magnetic switches). . . . . S U NA

7. A master control "panic stop system" is available and conveniently located in each laboratory to shut off power, with a minimum of two panic buttons. . . . . S U NA

8. Each laboratory area has its own key-operated master control switch and power panel S U NA

9. Laboratory power panels have clearly identified individual power switches for each machine or branch circuit. . S U NA

10. Extension cords are not used for permanent installation . S U NA

11. All hand-held portable power tools are equipped with "dead man" controls as required by NJAC 6:53-7.4 . . . . . S U NA

12. Regulators, stands, and pilot lights are provided for all electric soldering irons . . S U NA

13. All electrical apparatus in areas of concnetrated vapors are vapor proof . . . . . S U NA

14. Ground fault interrupter protection is provided in wet or damp locations when electrical equipment is used . . . S U NA

15. Explosion-proof electrical system is provided in finishing rooms . . . . . S U NA

**********

H. EQUIPMENT

1. Safety instructions sheet is posted for the use of each machine . . . . . S U NA

2. Machines are in safe operating condition at all times . S U NA

3. "Out-of-Order" signs are secured to machines not in working order and power panel switch is in "off" position . . . . . S U NA

4. All machines are securely fastened in place per manufacturer's recommendations . S U NA

5. Machines and equipment are provided with guards meeting industrial standards, and guards are in proper position for safe machine operation . . . . . S U NA

   Special consideration is given to the following items:

   a. Squaring shears finger guard . . . . . S U NA

   b. Foot treadle stops on squaring shears . . . . . S U NA

c. Jointer knife guards (front and rear) . . . . . S U NA

d. Abrasive wheel safety eye shields . . . . . S U NA

e. Abrasive wheel tool rests . . . . . S U NA

f. Abrasive wheel guards . . S U NA

g. Table saw guard, including antikickback . . . . . S U NA

h. Radial saw guard (upper and lower) . . . . . S U NA

i. Radial saw forward stop and positive saw return . S U NA

j. Radial saw antikickback device and splitter . . . S U NA

k. Machine belt and pulley guards . . . . . S U NA

l. Air compressor belt guards . . . . . S U NA

m. Compressed air is not used for cleaning purposes until it has been reduced to less than 30 psi . . . . . S U NA

n. Compressed air is not used for cleaning purposes where possibility of eye injury exists . . . S U NA

6. Equipment control switches are readily accessible to the operator while he/she is in a normal operating position . . . . . S U NA

7. A positive "off" position switch is located on each machine . . . . . S U NA

8. Proper tools and materials are available for machine cleaning . . . . . S U NA

9. Hand-tool equipment is stored with sharp cutting edges protected . . . . . S U NA

10. Hand tools are properly maintained and kept sharp . . . . S U NA

11. Bench tops are in keeping with the activities planned (i.e., electrical bench tops are made of nonconductive materials) . . . . . S U NA

12. Properly designed and constructed safety stands and roll blocks are used . . . . S U NA

13. A sufficient supply of safety stands and roll blocks is available to meet the needs of the power mechanics areas S U NA

14. Engine stands are properly designed and constructed . . S U NA

15. All hoists and A-frames are properly constructed, designed for the job undertaken, labeled as to capacity, and fitted with a safety block . . . . . S U NA

I. FIRE

1. When available, only U.L. approved equipment is used. S U NA
2. Sufficient and proper fire extinguishers (periodically inspected, dated, and recharged) are readily accessible in all activity areas. S U NA
3. A fire blanket is available for clothing fires. (Special caution is taken with polyester clothing.) . . . . S U NA
4. Location of fire extinguisher is color-coded. . . . . S U NA
5. Extinguishers are hung at approved heights. . . . . S U NA
6. Adequate exit doors and open aisles are available for prompt evacuation. . . . . S U NA
7. Approved storage cabinets and waste containers are readily accessible and used. . . . . S U NA
8. Oily waste containers are emptied daily. . . . . S U NA
9. Parts wash (solvent) tanks are fire fused. . . . . S U NA
10. Filters in spray booths are replaced regularly. . . . . S U NA

**********

J. WELDING

1. Proper protective clothing is worn when needed. . . . . S U NA
2. Approved goggles with proper lenses are used when torch welding. . . . . S U NA
3. An approved arc-welding helmet, with correct shade lens, is used when electric welding. (Minimum shade: #12-MIG & TIG; #10-standard arc) . . . . . S U NA
4. Observers use acceptable protection. . . . . S U NA
5. Welding is done only in areas free of combustible materials. . . . . S U NA
6. Cylinders are secured upright, clear of passageways, and are properly stored in ventilated areas. . . . . S U NA
7. Extra cylinders are properly stored. (Meeting regulations of NJAC 6:53-6-1.) . . S U NA
8. Gas pipelines have been installed and are maintained according to code. . . . . S U NA
9. Pipelines are checked each year by persons knowledgeable with code requirements. . . . S U NA
10. Piped welding systems have back pressure valves in both lines and conveniently located shutoff valves which are not quick opening. . . . . S U NA
11. Torches and regulators are clean, well-maintained, and in good operating condition. . . S U NA
12. Hoses are maintained in good condition and are inspected regularly. . . . . S U NA
13. Only spark lighters are used to light torches. . . . . S U NA
14. Anti (fire) flashbacks are installed where required in all hoses and lines. . . . . S U NA

15. The welding area is located in such a manner that an arc cannot be struck on gas cylinders, gas lines, or water lines. . . . . S U NA

16. Nonreflective screens are provided and used to protect others from arc flashes and burns. . . . . S U NA

17. When items to be welded do not fit into screeened area, all persons near area are provided proper protective equipment. . . . . S U NA

18. Arc welding is done in dry areas only. . . . . S U NA

19. The electrode holder is maintained and stored in good condition to eliminate possible accidental arcs. . . . . S U NA

20. Proper ventilation is provided. . . . . S U NA

**********

K. GAS

1. Gas-operated equipment is ignited from an automatic ignition system or pilot light. . . . . S U NA

2. The main supply cutoff valve is identified, is readily accessible, and is located outside possible heat or fire areas. . . . . S U NA

3. A key-operated solenoid type valve controls the main gas supply line in the shop. . . S U NA

4. Gas equipment is provided with a shutoff valve and a safety system (i.e. spark ignition, gas pressure regulator, safety gas check valve, etc.). . . . S U NA

5. Only nonflammable insulating materials are installed adjacent to gas appliances. . . . S U NA

6. Warning signs are posted when hot metals are poured. . . . . S U NA

7. Properly designed and constructed equipment is used for handling molten metal when casting. . . . . S U NA

**********

RECOMMENDATIONS

APPENDIX K

END-OF-YEAR CHECKOUT CHECK LIST

Hy Kaliber Regional High School
Industrial Arts Education Department
Shop _____ Room _____ Teacher _____ Date _____

## Facility

| | Yes | No |
|---|---|---|
| 1. Does the shop need to be painted? | | |
| 2. Does the shop floor need to be redone? | | |
| 3. Do safety zones need to be painted? | | |
| 4. Do nonskid surfaces around machines need replacement? | | |
| 5. Were fire extinguishers serviced recently? (_____ date) | | |
| 6. Are fire extinguishers in working order? | | |
| 7. Are exit doors in good working order? | | |

## Equipment and Furniture

| | Completed | Unfinished |
|---|---|---|
| 1. Clean, check, lubricate, and perform minor repairs on machinery. | | |
| 2. Remove blades and cutters. | | |
| 3. Oil or wax machined surfaces to prevent rusting. | | |
| 4. Paint machines and furniture, as necessary. | | |
| 5. Repair and refinish bench tops, as necessary. | | |
| 6. Check to see if all guards and safety equipment are in working order. | | |
| 7. Package blades or cutters to be sharpened, and notify the department head. | | |
| 8. Turn off compressor, ovens, blueprint machine, (list all serviced equipment/machinery). | | |
| 9. Inventory machines and furniture. | | |
| 10. Prepare a list of repairs to be made during the summer months. | | |
| 11. Post safety instructions for the use of each machine. | | |
| 12. Surface and make bench tops ready for next year. | | |

## Tools

| | | |
|---|---|---|
| 1. Return all tools to their proper storage area. | | |
| 2. Construct, repair, and/or paint tool holders. | | |
| 3. Clean, repair (if necessary), sharpen, and adjust all tools. | | |

| | Completed | Unfinished |
|---|---|---|
| 4. Tools necessary for next year's first demonstration are ready for use. | | |
| 5. Inventory hand and portable power tools. | | |
| 6. List of unsafe tools to be discarded has been handed to department head or school administrator. | | |

## Sanitation

| | | |
|---|---|---|
| 1. Clean, repair, sanitize, and store safety glasses and shields. | | |
| 2. Clean and sanitize safety glasses storage cabinet. | | |
| 3. Inventory safety equipment. | | |
| 4. Package lab coats for laundering. | | |
| 5. Clean lockers, gallies, and other student storage areas. | | |
| 6. Clean tool and storage areas. | | |
| 7. Discard unusable odds and ends that have accumulated during the school year. | | |
| 8. Discard supplies (paints, varnish, cleaning fluids, thinners, etc.) in cans or bottles that cannot be sealed tightly. | | |
| 9. Discard dirty or oily rags. | | |
| 10. Clean used paint brushes. Discard if they cannot be cleaned properly. | | |
| 11. Remove all trash and rubbish. | | |
| 12. Vacuum dust from machines. | | |

## Security

| | | |
|---|---|---|
| 1. Lock tool storage cabinets. | | |
| 2. Check and lock windows and closet doors. | | |
| 3. Shut off electrical power. | | |
| 4. Lock storage areas. | | |
| 5. Lock desk (if possible). | | |
| 6. Close and lock laboratory. | | |

## Teaching Materials

| | | |
|---|---|---|
| 1. Collect, clean, inventory, and store all books. | | |
| 2. Return audio-visual equipment to the media center. | | |
| 3. Construct, repair, and store audio-visual materials. | | |
| 4. Duplicate forms, safety tests, measurement tests, etc., for the start of next year. | | |
| 5. Clean and organize teacher's desk and file cabinets. (Take home personal items of value.) | | |
| 6. Review and update materials in the file cabinet. | | |
| 7. Order and confirm films needed for the coming year. | | |
| 8. Hand in record book, teacher's plan book, and other materials needed by the administration. | | |
| 9. Tag keys with appropriate identification. | | |
| 10. File key list, with explanation of what each key opens, with appropriate school officiel. | | |

APPENDIX L

## Vocational Education Safety Standards

Note: This document will be mailed to all those who have a manual as soon as it is printed with revisions. Please send requests to:

William R. Smith
Division of Vocational Education & Career Preparation
State Department of Education
225 West State Street
Trenton, NJ 08625